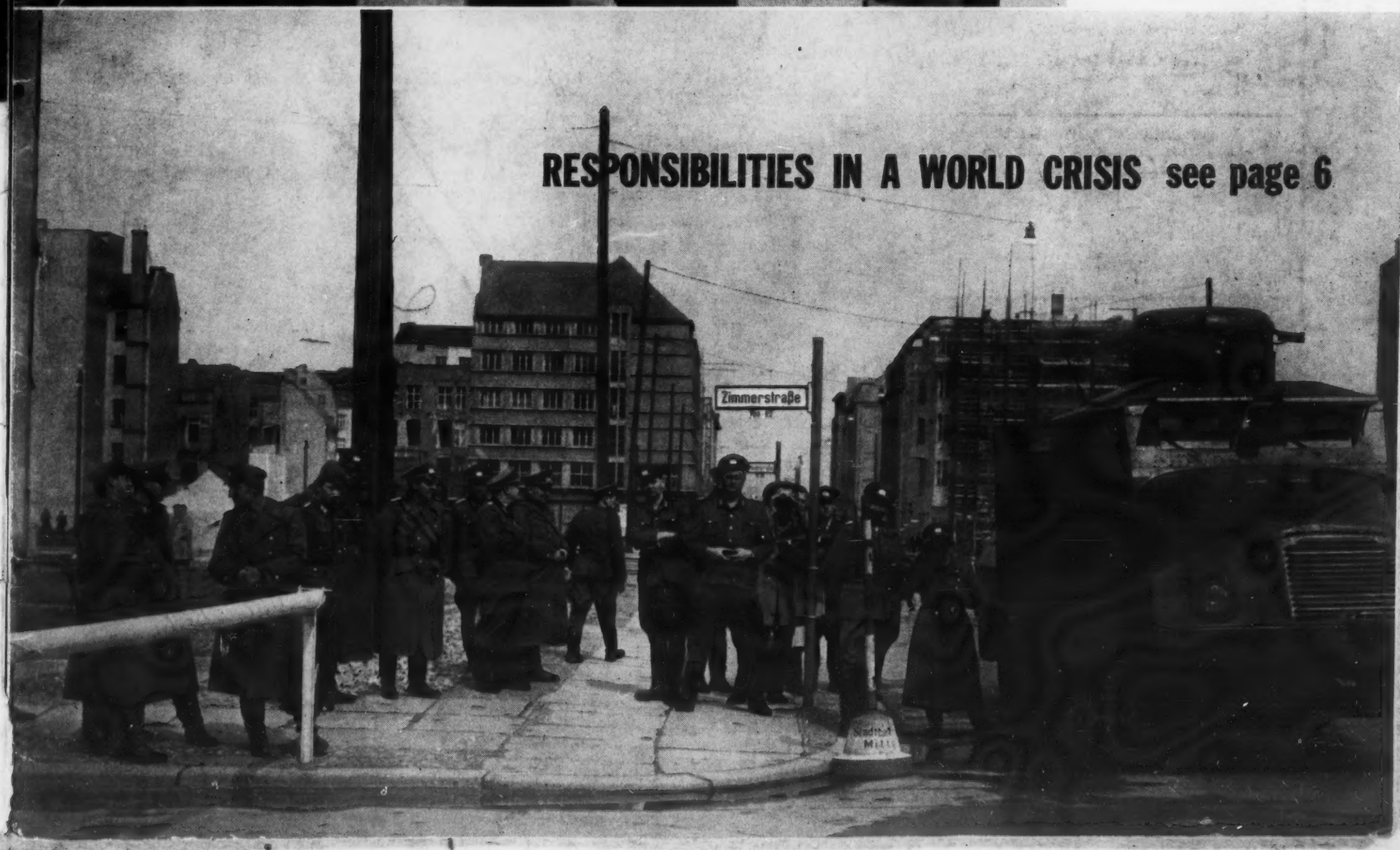
SIGNAL

October 1961

RESPONSIBILITIES IN A WORLD CRISIS see page 6



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Offset Voltage V_{EC}(T2357 Matched Pair, $I_B = -1ma$ at all temperatures from 25° to 85° C)	50 μv max.

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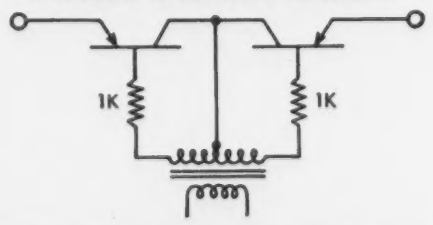
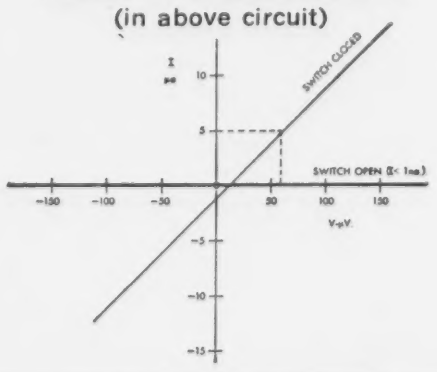


T2363: I-V CHARACTERISTIC
(in above circuit)



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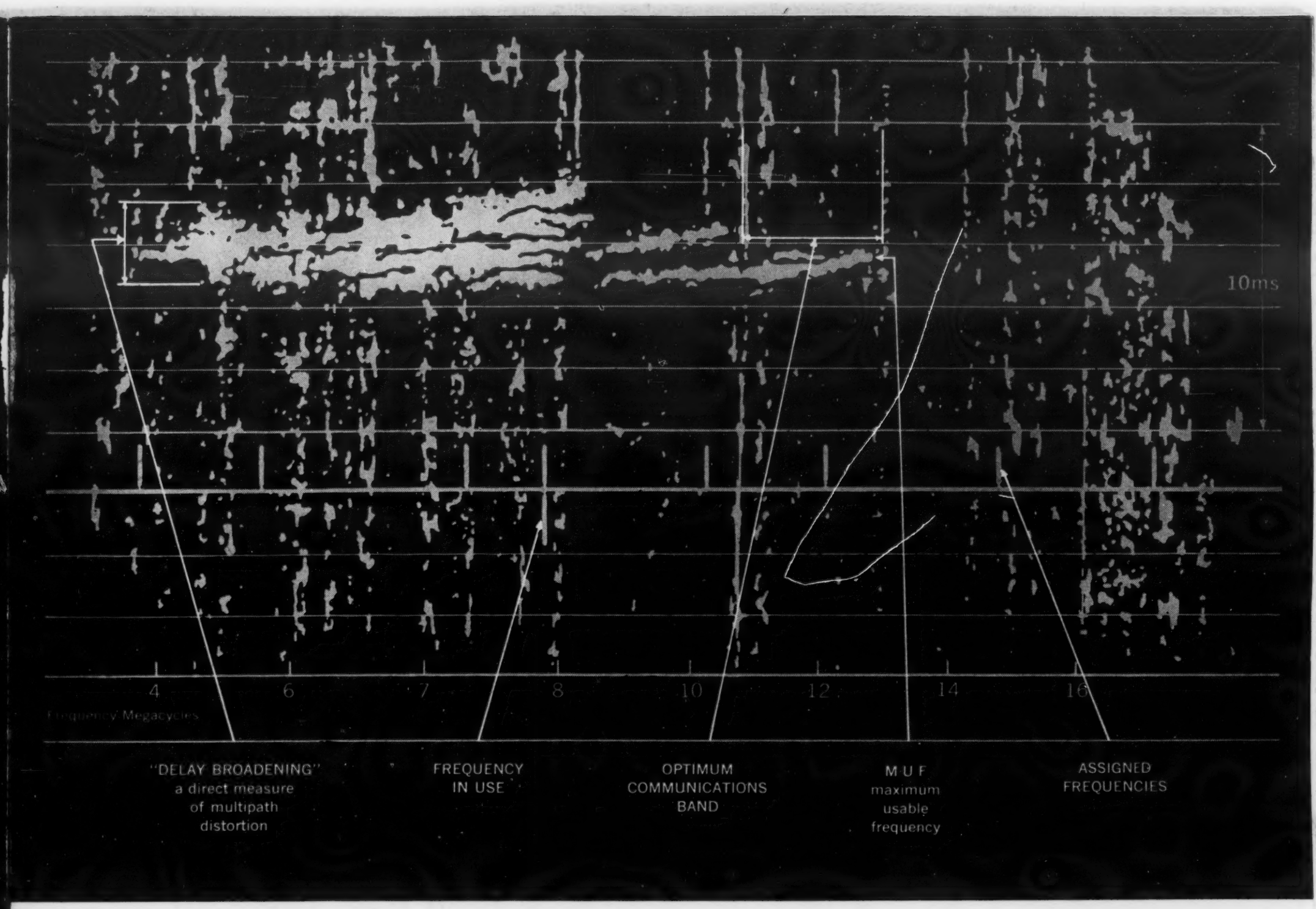

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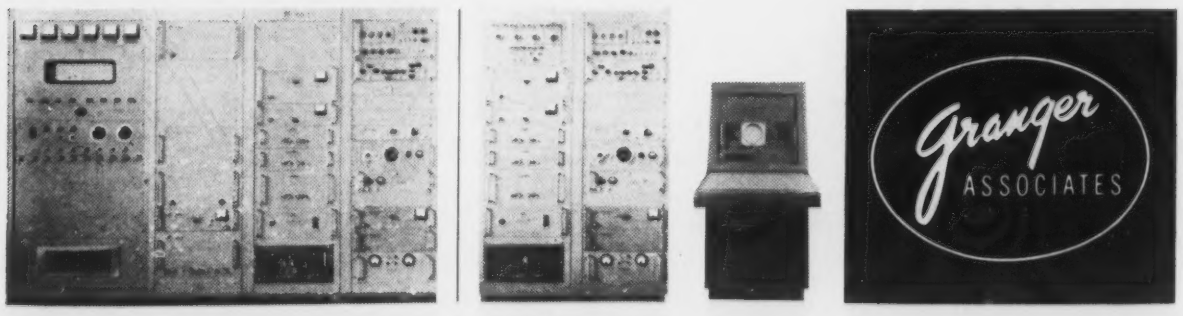

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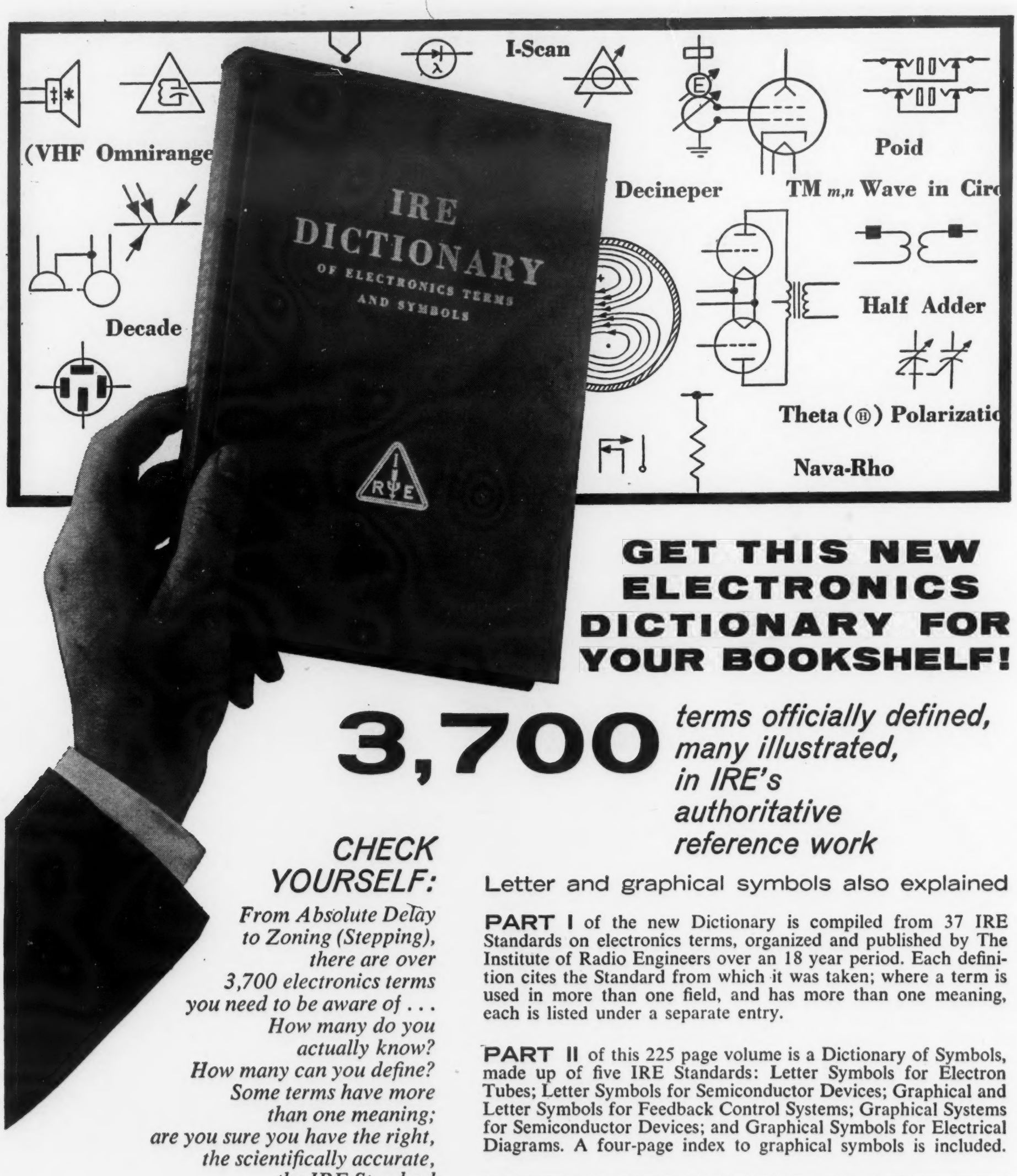

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SIGNAL is published monthly by the Armed Forces Communications and Electronics Association at 1624 Eye St., N. W., Washington 6, D. C. Second class postage paid at Washington, D. C., and at additional mailing offices.

Subscription rate to members of the AFCEA: 1 year (12 issues), $5.00. To non-members, $7.00. To foreign post offices, $8.00. Single copies, $1.00 each. Printed in U.S.A. by Monumental Printing Co. at Baltimore, Md. The publisher assumes no responsibility for return of unsolicited manuscripts or art. When sending change of address, please list the old and the new address, and allow 3 weeks for delivery of first copy.

BPA

SIGNAL

Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME XVI OCTOBER 1961 NUMBER 2

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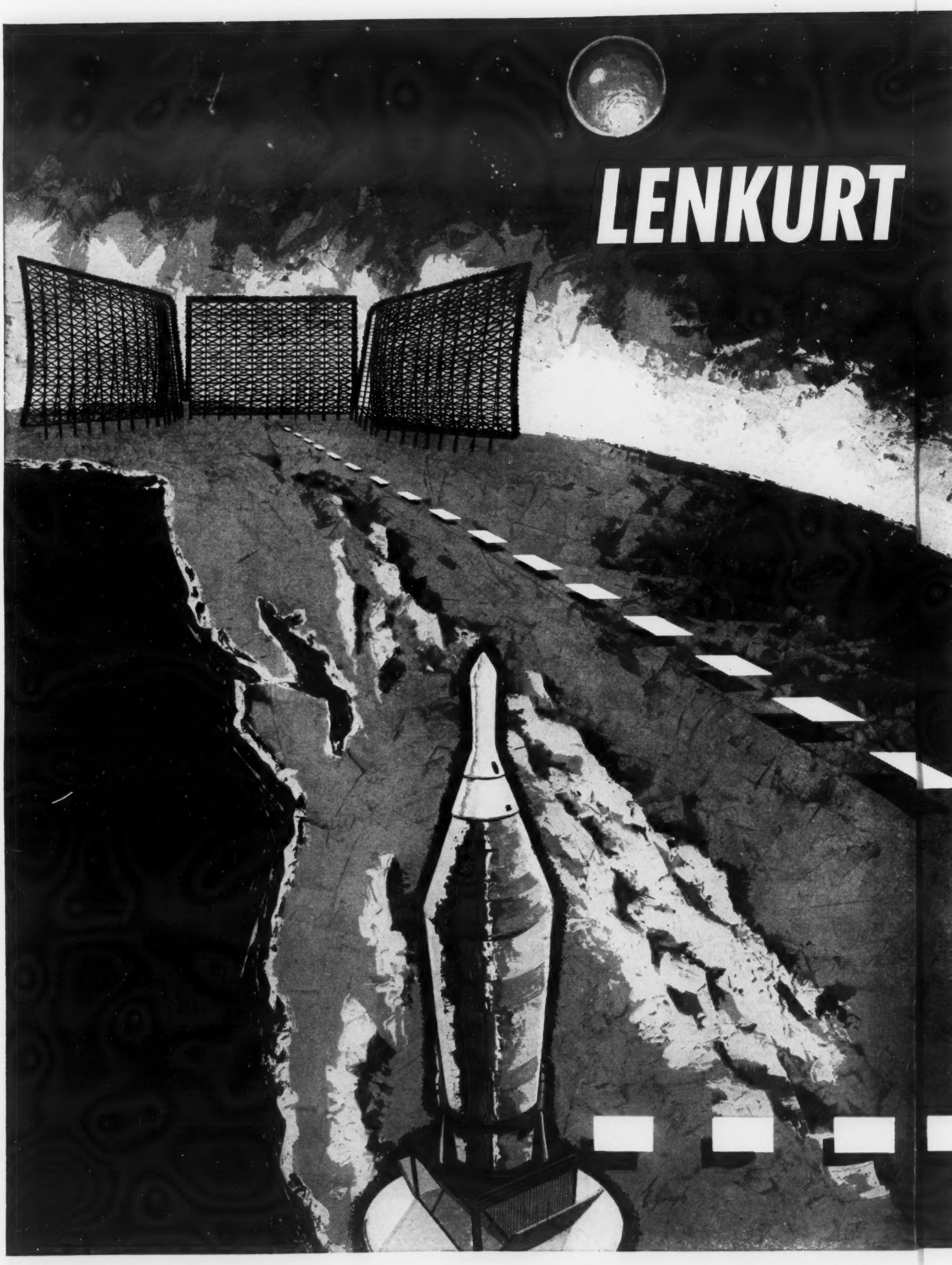
Cover

"If there is a dangerous crisis in Berlin—and there is—it is because of threats against the vital interests and the deep commitments of the Western powers, and the freedom of West Berlin. We cannot yield these interests. We cannot fail these commitments. We cannot surrender the freedom of people for whom we are responsible."

President Kennedy—United Nations—25 September, 1961

. . . Members of Company B, 2nd Battle Group, 6th Infantry are shown in the top photo as they face East German police and water wagon (bottom photo) at the Friedrichstrasse crossing of the East-West Berlin sector border.

DEPARTMENTS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RESPONSIBILITIES in a world crisis

by ADMIRAL ARLEIGH BURKE, USN (RET.)
Former Chief of Naval Operations

MY OWN CAREER IN THE NAVAL service now has come to a close. After 42 years of duty—many years of peace and some of war—I am starting my retirement with considerable anticipation. I've sailed with the Navy all my adult life, in fair weather and foul. And as I left her (1 August), she still remained the finest fighting force the world has ever seen. I am confident she will move out smartly in the future, under the very able leadership of our new Chief of Naval Operations.

I have left my naval duties in the hands of Admiral Anderson. But there are other responsibilities that I never can relinquish: the responsibilities that every citizen in our democracy faces. For no matter what our professions may be, no matter whether we are active or retired, each of us bears the responsibilities of his citizenship. Each of us carries his own share of the responsibilities that are fundamental to our concept of government—responsibilities that are dictated by conscience and directed by principles. These responsibilities are not unique to our era. My father and your fathers—all of our forebears—were required to meet the same type of responsibilities. Fortunately for this Republic, history shows that our forebears met them well, met them with wisdom and with the God-given strength that walks hand-in-hand with courage.

Each age faces its own conflicts and its own challenges. But the fundamental fact of our age, a fact blurred neither by symbolism nor by rhetoric, is that the future of the Free World, the conditions of human life for years to come, are being determined *now*. The fate of our country—the future existence of our way of life—depends on what we as a nation, what we as individual citizens are willing to do *today*.

Clearly astride our path toward a world of justice and order stands the relentless force of communism, a godless ideology that finds its seat of power and its center of control in the Soviet Union. Now one thing is most apparent about the leaders of the Soviet communist state today. They have become confident—very confident. And with their confidence they have developed arrogance. That is why they are talking tough; that is why Khrushchev has dared to challenge us over Berlin. The reason for this confidence is that some fundamental changes have occurred in Soviet Russia particularly in the last 5 or 6 years.

"Realistic" Communists

Just a little over forty years ago, communism was virtually confined to a rented room in Zurich. When the Bolsheviks seized power they had *nothing*—certainly nothing of which to be proud. In every area of the world there were countries with better industries, better schools, better farms and better housing. The communist leaders felt inferior—and they *were* inferior. But men like Lenin and Stalin were, above all, realists. They recognized this inferiority and they developed programs to change matters. The fantastic cost of these programs —not just in rubles, but in degradation, deceit and despair—was of no consequence. The communist hierarchy readily accepted the law that "the end justifies the means." Purges, pogroms and persecution were integral parts of their five-year plans. Yet these men were as diligent as they were ruthless. They worked hard, with concentration and great singleness of purpose and now, in the last decade, their plans have begun to pay off.

Soviet Confidence

The Soviet emphasis on scientific training gave birth to Sputnik, to Lunik and to their man in space. For the first time in Soviet history, they accomplished something before anyone else and real accomplishment, in *any* society, is the father of confidence. The communists now feel they are better than the rest of the world.

That is *one* reason why they are confident. But there is *another* reason which is just as important. The communists have watched their "enemies" in the West very closely. They have looked for signs of weakness: for weakness in our alliances, for weakness in our decisiveness, for weakness in our will. The communists have probed the soul of the Free World to see if we *really* practice what we preach, if we are *really* willing to stand up for principles—rather than merely spout pious platitudes. They have watched our deeds and ignored our diction. And all too often they found us wanting, our words trailing off to inaction and our opulence expressing itself in complacency.

Many of the communist leaders do not believe that we in the United States will stand up for our principles. They do not believe that we will risk a fight for what we know is right. Ambassador Menshikov has expressed this attitude very clearly. He stated that ". . . when the chips are down the American people won't fight for Berlin." He would like to promote such a notion.

And so with a growing arrogance born of their *own* confidence and of *our* suspected weakness, Khrushchev has thrown the issue of Berlin in our faces.

Importance of Berlin

But in considering Berlin, it is extremely important that we recognize one fact. The future of the half-city of Berlin, this "bone in Khrushchev's throat," is not an issue distinct and separate from the many other pressing international issues that confront our nation. Berlin is isolated geographically, but politically, it is intimately related with everything else that is unfolding in the world: with the communist aggressions in Laos and South Vietnam; with communist exploitation of the situation in Cuba, and with the growing pressures throughout Latin America. The question of the freedom or slavery of West Berlin is a very real part of *all* our relations with the Sino-Soviet bloc.

Even if Khrushchev had not chosen to confront us with this issue at this time and at this place or if the issue of Berlin becomes not a crisis but an unresolved question, we can be sure that the communists still will continue to present us with other issues, at other times and other places, in their drive toward world empire. Sometimes these issues will be primarily of a military nature. At other times they will be economic, or psychological, or political. But one thing is certain. The patterned policy of communist pressure and conflict will continue at an accelerated rate as long as they can hope that such a policy will be rewarding.

Naturally, our attentions now are focused on Berlin. Our efforts and our energies are directed toward Berlin because the issue is related to far *more* than the hopes and aspirations of 2 million Berliners, far *more* than to the ultimate reunification of a free Germany. Berlin is a symbol—a symbol of freedom— safeguarded by Western unity and resolve. And the nature of our response either can strengthen that freedom, that unity and that resolve—or it can bring an end to our united strength. Our treaties and treaty obligations are all in jeopardy and should we vacillate or falter the ultimate collapse of NATO—of SEATO and CENTO, of *all* our arrangements for mutual security—could well be measured in months, if not in weeks.

A Test of Will

You can be sure that Khrushchev recognizes the broad import of this issue. *He* is initiating the crisis in Berlin. There would *be* no crisis without his action. He is using this issue to test Free World stamina, courage and strength of purpose. He is initiating this test of will—or perhaps it should be this test of willingness to stand for principle.

Khrushchev, perhaps better than many Americans, is aware of the profound effect this issue will have not only on those allied with us in common defense but—just as importantly—on the uncommitted nations, on the emergent countries, on the wavering and the faltering. By pressing the question of Berlin in an acute and threatening form, Khrushchev hopes to impress these countries with the strength and power of the communists, and to demonstrate that the way of the future will be the communist way.

The complicating factor is that they don't plan to take over Berlin in one swallow. As Willy Brandt puts it, the Soviets will use "salami tactics" to slice away freedom a bite at a time, just as they are seeking to do in the rest of the world.

The communists will not confront us with the direct

question of Soviet Union supremacy because they know we wouldn't accept that supremacy. But they will use the East German Government to serve as their proxy, to gradually erode our legal rights—rights that were obtained not by grant nor by negotiations with the Soviets but rights that were won by war and confirmed by a series of agreements since 1944.

First they will want us to accept the validity of the "German Democratic Republic," a tyranny neither chosen by the people nor responsive to their will. The communists will make it appear that what is at stake is not freedom of West Berlin and Western access but merely a legal title, a paper transaction with all rights remaining intact.

Need for Firm Stand

In the beginning, the status of Berlin may appear unchanged. But with the passage of time, the controls will tighten; regulations will become more stringent. Bit by bit, we will be forced to pay greater tribute for access to Berlin—tribute in the form of harassment, difficulties and delays. The encroachments on our rights will increase and slice by inevitable slice, freedom will disappear until one day a city, now free, will be lost to the forces of communism without any issue appearing important enough for us to take a stand—without any "Pearl Harbor" to galvanize our actions.

That is why it is so important that we stand firm now, at the beginning, before the slicing process commences. Certainly, we always should be prepared to negotiate with the Soviet Union on the modalities, on the details of occupation and access to Berlin. That is in keeping with our national policy. But at the same time, we never can negotiate on our fundamental rights in Berlin. We must make it firmly understood that our rights, our obligations to live up to the treaty obligations we accepted in regard to Berlin—just as our rights and our obligations to free men everywhere—are *not* subject to negotiations nor to compromise. Our firmness, of course, will involve substantial risks—tremendous risks—but we must accept them. We must be prepared to do anything and everything our stand implies. The irony of the matter is that once the Soviets are convinced that we *do* mean business, that we *will* remain in Berlin at all costs, the risks of general war diminish rather than increase. The Soviets are well aware of our tremendous strength. They question only our *willingness* to use it.

Our ability to convince our communist adversaries that we are determined to stand fast will, of course, depend on more than threats or statements of intent. The credibility of our position will depend essentially on two factors. The first of these, is the willingness of the people of the United States to acknowledge and to accept, the possibility of a General War—the willingness to go all the way to win. Only after this decision has been reached and made abundantly clear both at home and abroad can the military decisions be made to handle the situation as it develops. But in times of peace—yet times of very definite peril—this willingness is sometimes difficult to engender. The pleasures of an easy summer and the comforts of a thriving economy can well obscure the seriousness of our times.

And it is here, in this area, that members of the press can make most telling contributions to our national security. For it is the members of the press who make our citizens aware of the issues, who can inspire our citizens with the "will to win."

Without undue preoccupation with the military aspects, without belligerence or propaganda, without exaggeration or dramatic speculation, the press can mobilize the opinions of 180 million people and point out the meaning of our commitment. The press can discuss the pitfalls and the perils. And with such enlightenment will come the individual and national willingness that will give credence to our words.

Naturally, the credibility of our stand would be seriously impaired should we fail to support our national will with the material things, with military hardware to reinforce our determination to help make our resolution both effective and believable. That is why President Kennedy, when he addressed himself to the problem of Berlin, also called for increased measures to strengthen our military forces in order to give us the additional naval power, the additional ground forces and air support, and the heightened readiness to prepare us more fully for whatever the future may bring—whether that future will continue to be an uneasy peace or a future darkened by limited or even a general nuclear war. Knowing the tremendous strength of our military forces, I can assure you that we will be ready for any eventuality.

If we want to preserve our society, we must practice the virtues that we praise. We must work harder to enlarge the advantages of free competition. As citizens, we must be willing to compete with one another and with the world; we must be determined that the United States will win that competition. We must have the *will* to win. As a nation we must strive to excel. Every worker, every union member, every executive and every student must re-emphasize the high standards of performance that are the backbone of our national strength. And with every act to improve ourselves and our nation, we must recognize that the very heart of any nation is its principles. Our principles must be the driving force behind our actions and the standard against which those actions are measured. For our principles and our willingness to stand up for them made this nation what it is today; and those same principles, that same willingness, will preserve us in the future.

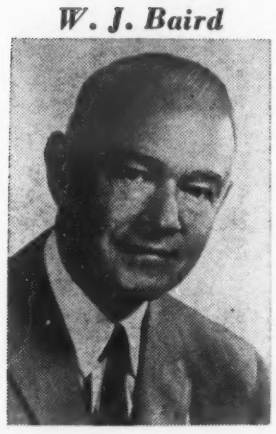
Freedom Not to Be Bartered

As I close, permit me to voice one more thought, directed not to Americans but to those outside this nation, to those who choose to stand with us and to those who may choose to stand against us. In the tragic aftermath of the Second World War, the United States expended significant energy and resources for the cause of all mankind. With a compassion and an understanding unique in history, we have aided both friend and former foe alike to recover from the destruction brought on by war. In the interest of the dignity and welfare of man we developed the Marshall Plan and other measures to alleviate misery, to raise hope in areas where there was only despair. We have not always been successful but we have tried. We have given freely and we have asked little in return. But there is one thing that we will *never* give, either willingly or through coercion—and that is *our* freedom or the freedom of those who ask our help.

There have been other men in other eras who misconstrued the temper of our people. The last three wars were started by nations that did not realize we would fight for our principles. They judged our efforts to promote peace as a sign of cowardice. They looked on our debates as a sign of division. They ridiculed our efforts to help others as "do-goodism," betraying weakness. To anyone in our era who might be prompted to make the same fatal miscalculation, I urgently suggest that he look to the past, before he projects himself into a fearful future.

COMMENTS BY THE EDITOR ON THE SPECIAL ANNIVERSARY ISSUE

W. J. Baird



Next month's issue of SIGNAL commemorates the 15th Anniversary of AFCEA. This issue provides a complete and comprehensive coverage of several vital areas of interest to communications and electronics personnel. It is hoped that the wide variety of opinions expressed by the distinguished authors will stimulate worthwhile discussion among the readers and keep them abreast of the times. The articles mentioned below are among other feature stories to appear in November. Also, SIGNAL will carry an AFCEA history, special recognition of firms who have been group members for 15 years, photographs of historic AFCEA activities and comments by AFCEA's National President, Frank A. Gunther.

Communications—A Look Ahead

by Brigadier General David Sarnoff, USAR, Chairman of the Board, Radio Corporation of America

RCA has advocated a communications satellite system consisting of two or three satellites positioned about 22,000 miles above the equator in a stationary or synchronous orbit. General Sarnoff sets forth his comments on this proposed system which he believes would be "capable of achievement in time to meet the communications demands that will overburden international submarine cable and radio circuit facilities later in the Sixties." General Sarnoff also discusses the exploratory plans which RCA and other companies are making for the U.S. manned moon shot.

Big Era in Space Communications

by H. E. Weppler, Radio Engineer, American Telephone & Telegraph Company

Bell Telephone Laboratories will conduct two communications satellite experiments in 1962 in an effort to measure transmission characteristics under conditions of orbital operation and to check the performance of tracking facilities. Mr. Weppler explains how these spherical, experimental 125-pound satellite systems will work and discusses ATT's proposed communications satellite system in which 30 to 50 satellites would be placed in polar orbit at 7,000 mile altitude.

Status of Thermionic Converters

by J. F. McAllister, General Manager, Power Tube Department, General Electric Company, Schenectady, N. Y.

In less than one year's time, thermionic converter power output has been increased from 1 watt to 23 watts per unit, with an increase in operating efficiency from 2.5 percent to 16 percent. In the November issue of SIGNAL, Mr. McAllister reviews the present status of these generators and describes such systems under development and proposed. He provides a forecast of millions of watts of power and describes new types of converters that are possible with continued R&D funds.

Space Communications and Cooperation with Iron Curtain Countries

by Andrew G. Haley, General Counsel, American Rocket Society

The broad implications of space communications are increasingly playing a major role in several areas of our country's foreign policy. As the importance of an American policy on space communications becomes better appreciated, the need grows for an understanding of the Communist approach to the problems involved. Mr. Haley, in Part I of a two-part article, outlines the need for international cooperation in space telecommunications and explains some technical considerations involved in reaching international agreements in this area.

Today's Challenging Requirements

by Rear Admiral Frank Virden, USN, Commander, Cruiser-Destroyer Force, Pacific Fleet

It has been predicted that by 1970 the electronics industry of this country will be grossing $20 billion annually. In the November issue of SIGNAL Admiral Frank Virden comments that how we use this $20 billion will not make a significant difference to the industry as a whole, but it can make all the difference to the strength of this Nation.

In this article, Admiral Virden clearly defines the urgent requirements of military communications in general and specifically, those of the Navy. He encourages everyone of influence and responsibility in these areas to think more in terms of the over-all task of defense and less in terms of specific hardware systems.

Trends in Weapons Systems Development

by John H. Rubel, Office of Secretary of Defense, Deputy Director, Research & Engineering

Lessons of management learned through experience in the enormous undertaking of Defense R&D, have been often painful and, at times, costly, comments John H. Rubel in the November issue of SIGNAL. A certain amount of duplication of effort and even what appeared to be wasteful effort was the price we willingly paid in return for the material benefits of concurrency. Experience indicates that in many areas, we could have had the deployed systems needed with less frantic and less expensive effort.

Mr. Rubel describes the changes being made in the way Defense R&D is being and will be conducted to achieve a more forward-looking and better integrated program.

More Communications for Defense

by Thomas F. McMains, Vice President and Assistant to the President, The Western Union Telegraph Company

The record shows that the military-industry team is producing new communications systems and techniques in mass, variety and capability unsurpassed by any rival power. But this is no time for complacency. The pressures of time, the swift march of events and inventions, and the forces of automation are combining to create a telecommunications explosion in the near future.

The author sees the growth timetable of telecommunications in this country—record and voice combined—as $12 billion or more in five years and one in excess of $16 billion—or double present volume by 1970.

THE VOICE OF COMMAND gives the order for launch. Via a direct line between control center and launch site this man can command instantaneous firing of space vehicles or weapons. At the present rate of technological growth, communications-electronics systems could undoubtedly become capable of detecting an attacking air weapon, identifying it, reporting its presence to an entire continent, selecting the weapon to attack it, launching the weapon, guiding it to the destruction of the target, and simultaneously launching a retaliatory force—all without the necessity of a single person getting into the act. However, a completely automated system of this nature is unlikely ever to be used. The final decisions must always be made by people. Next June the 16th Annual AFCEA Convention will bring together, in the Nation's Capital, people who make decisions—people who discover, design, devise, develop, test, operate and maintain—people from the military, from government, from industry and from universities—people who think, reason and decide. As in the past there will be high-level exchanging of ideas and information. June 12, 13, 14, 1962, Sheraton-Park and Shoreham Hotels, in Washington, D. C. **16th AFCEA CONVENTION**

TEACHING MACHINES

by

DR. THOMAS P. CHEATHAM, JR.

Vice President

Litton Systems, Incorporated

THE HISTORY of the development of audio-visual techniques in their application to the industrial, military and educational fields is not new; it dates back approximately 30 to 40 years to the preliminary groundwork of Professor Pressey of Ohio State University.

The recent advances and applications of teaching-machine techniques and theory made by Professor Skinner of Harvard and Dr. Crowder of United States Industries, have given new emphasis to this increasingly important field at a time when various areas of application are in critical need of the innovation and evolution that only teaching-machine philosophy provides. It is interesting to note that there has been an exponential rise in audio-visual activity throughout the world and that, whereas the United States has been a pioneering father in this important field, our activity has been matched by that of the Soviet Union in the last two years.

What is a teaching machine? In general, it is any device that satisfies the following four requirements:

(1) It presents a set of programmed step-by-step instructions.

(2) It is self-pacing.

(3) It provides for a response on the part of the operator.

(4) It provides feedback as to the appropriateness of the response.

Essence of Teaching Machine

What is the essence of a teaching machine in terms of its philosophy of application? It teaches a student or operator to *do* something rather than to just *know* something. This represents a significant change in the philosophy and measure of stature in our present educational system. A man is now valued for what he can do rather than for what he knows. The so-called educated dilettante can no longer be respected unless he uses his talents to some useful and definitive end. The statistics now available regarding the large increase in efficiency in learning time through the use of programmed material is no accident; it accounts, in fact, for the significant progress made in the Soviet Union in recent years. It is because of the Soviet Union's proficiency in this field that they have overtaken the free world's technological lead, despite the fact that the richness and depth of America's educational system is unequalled in most of the world.

The areas of potential audio-visual and teaching aid application can best be considered in terms of priority of time:

(a) In industry; (b) In the military; (c) In the educational needs for underdeveloped areas; (d) In the educational requirements for America's own school system, both on primary and collegiate levels.

Industrial and military applications come first, because their economic usefulness can be readily measured. The significant advantages resulting from a two-to-one increase in output and corresponding ten-to-one reduction in errors as compared with the cost of introducing new techniques and equipment is directly translatable into profit dollars. The reduction in training time of a four year Army, Navy or Air Force recruit in the operation and maintenance of weapon systems and other complex equipment is directly translatable into dollar savings of the defense budget. The need to operate complex electronic and mechanical equipment over a wide geographical area with quick response and high reliability far from maintenance and training bases is not only translatable into dollars of the defense budget but into a more critical item: that of survival itself.

Third in order of priority—not in need, but in acceptance—are the educational areas in the underdeveloped countries of the free world. Here we are faced with the dilemma presented by the sudden "revolution of expectations" now affecting nearly all backward peoples. The elements of this dilemma are:

(a) The growing realization by primitive and backward peoples everywhere of the enormous gap between their living standards and those of more favored parts of the world; (b) Their expectation and demand for quick and radical improvements in their living standards, and (c) The absolute inability of any government to quickly accomplish radical improvement of most elements of standard living (i.e. large changes in per capita productivity and income are accomplished in a decade rather than in months.)

The establishment of a new background and tradition based on a radically improved standard of living is, therefore, a very difficult objective to accomplish in a short time. But by establishing specific objectives, the resulting ability to do something in a short time—such as solving a particular type of business or algebra problem, operating and maintaining a specific communications system, building a rocket, selecting a specific type of tractor, introducing specific dental and medical practices and services, etc.—is well within the capabilities of our systems (and theirs). The thirst in many underdeveloped areas for specific knowledge of the new technologies that have grown so vigorously here in the United States is apparent, and will create a foreign market for the mechanism and vehicle most suited to the efficient transfer of such

(*Continued on page* 16)

—GOVERNMENT—

NEW MILITARY INTELLIGENCE ORGANIZATION has been established within the Defense Dept. The Defense Intelligence Agency (DIA) will report through the Joint Chiefs of Staff to the Secretary of Defense and will combine a number of intelligence functions previously carried out independently by the separate military departments. Lt. Gen. Joseph F. Carroll, Inspector General of the United States Air Force and a former member of the Federal Bureau of Investigation, heads DIA. Maj. Gen. William W. Quinn, Army Chief of Public Information, is DIA Deputy Director and RAdm. Samuel B. Frankel, Deputy Director of Naval Intelligence, is Chief of Staff for the new agency.

RECENT DOD TECHNICAL APPOINTMENTS have been announced. Dr. Clifford C. Furnas, Chancellor of the University of Buffalo and former Assistant Secretary of Defense, has been named Chairman of the Defense Science Board. Dr. Frederick Seitz, head of the physics department of the University of Illinois and Chairman of the Naval Research Advisory Committee, has been appointed vice chairman of the Defense Science Board. A new position has been created within the office of the Director of Defense Research and Engineering. Arthur W. Robinson, Jr., Manager of Space Business Development at General Electric Co., has assumed this post as Assistant Director of Defense Research and Engineering for International Programs. The position was established to effect closer integration of the defense research and development efforts of the individual countries which are suppporting and strengthening the solidarity of the Western community. Fred A. Payne, Jr., manager of Advanced Systems Planning at North American Aviation, Inc., has been named Assistant Director of Defense Research and Engineering for Strategic Weapons.

BILL TO PERMIT LICENSING OF FOREIGN HAMS has been introduced by Senator Barry Goldwater, Arizona Republican. The bill would permit reciprocal licensing of foreign amateur radio operators who are residents of those nations which extend similar privileges to American amateur radio operators. The licenses would be issued for any temporary period, not in excess of three years. The bill, which would amend certain sections of the Communications Act of 1934, has been referred to the Senate Commerce Committee, which has requested comments from various Government agencies. When Congress reconvenes in January it is expected that the Senate committee will hold hearings on the bill.

GOVERNMENT FUNDS may be used to pay defense contractors' costs of advertising in trade and technical journals if the advertising is for one of the following purposes: "(1) the recruitment by that contractor of personnel required for the performance by the contractor of obligations arising under a defense contract, (2) the procurement of scarce items required by the contractor for the performance of a defense contract, (3) the disposal of scrap or surplus materials acquired by the contractor in the performance of a defense contract, (4) the procurement of subcontractors required for the performance by the contractor of his obligations under a defense contract. . ." These items are contained in the 1962 Defense Appropriations Act, Sec. 636.

AFCS SQUADRON provides control of all allied traffic into the divided city of Berlin, 110 miles inside the Communist territory. The 1946th Communications Squadron, part of the Air Force Communications Service, maintains constant surveillance over the three air corridors established to control traffic into the Western sector of the German city. The 1946th provides basically the same services to all allied aircraft arriving or departing. There are three allied airfields in West Berlin, for the British at Gatow, the French at Tegel, and the United States' field at Tempelhof. The squadron provides radar assistance and aircraft separation in the three air corridors; its controllers keep the steady flow of traffic within the confines of the corridors at all times, then feed the traffic through approach control to any one of the three airfields.

NEW AF APPROACH TO SYSTEMS DESIGNING is being put into effect at the Electronic Systems Division of the Air Force Systems Command. Under the new approach, greater emphasis is being placed upon "in-house" design and management of command and control systems, with the result that fewer prime systems contracts will be let. "In the past each command and control system was developed by a prime contractor who managed the system development, performed the over-all design, and even prepared specifications," Dr. Brockway McMillian, Assistant Secretary of the Air Force for Research and Development, recently stated. "It is not likely," he said, "that we will continue this practice. We shall rely on the competence available to the Electronic Systems Division at Hanscom Field for systems specifications, and we will select contractors to be implementers of hardware rather than basic system designers."

ENLARGED ROLE IN AF WORK will be undertaken by Mitre Corp. as a result of the new Air Force approach to systems designing. Mitre, a "not-for-profit" organization, is technical adviser to the Air Force for command and control systems. Under the new procedure Mitre will be responsible for advanced systems analysis and planning, research, experimentation, initial system engineering, initial technical direction and intersystem engineering in a relationship similar to the one between the Aerospace Corp. and the Air Force Space Systems Div., the Air Force states.

WORK ON NORAD CENTER represents the first major step in the Air Force transition to the new "in-house" approach from the former concept of having a prime systems contractor. The development and production work is being done on an automated combat operations center, designated System 425L, for the North American Air Defense Command. This system will collect, process and display air defense intelligence from all Air Force warning and communication networks. The NORAD system will be built by an Air Force-industry team under management of the Electronic Systems Division of the Air Force Systems Command. Mitre Corp. and System Development Corp., two "not-for-profit" firms, will provide the Air Force with general systems engineering. Burroughs Corp. will be responsible for detail design, acquisition, installation and test of the equipment.

FOUR RANGER SPACECRAFT have been added to the existing Ranger Lunar Exploration Program, as part of the accelerated program to land an American on the moon by 1970, the National Aeronautics and Space Administration reports. The addition brings to nine the number of unmanned spacecraft that will be launched in this phase of the program to explore the moon. Mission of the four new Rangers will be to send back to earth stations high resolution television pictures of the lunar surface up to the moment the spacecraft lands on the moon. Radio Corporation of America, Astro Electronics Div., will develop the spacecraft TV systems.

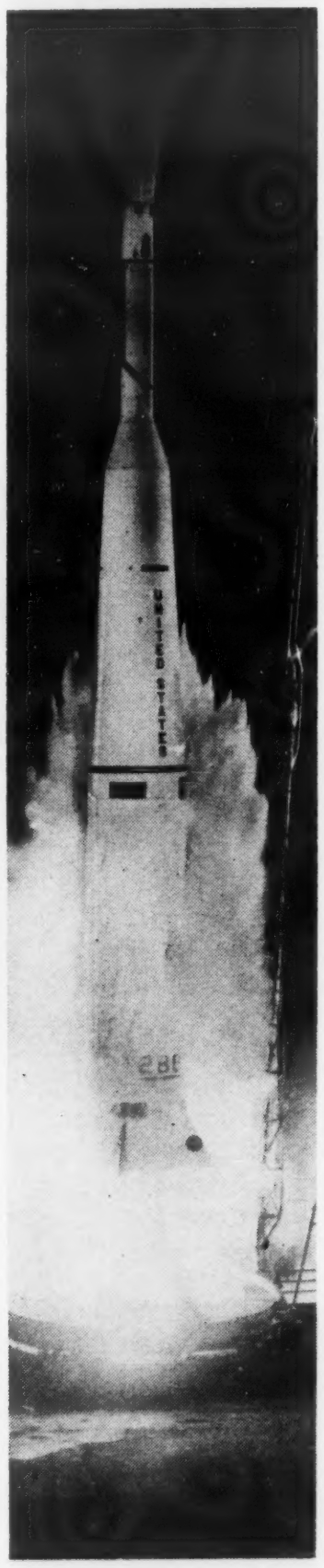
U. S. MANNED ORBITAL SHOT probably will not be attempted until early next year due to certain malfunctions which occurred in the robot space ship orbited last month. National Aeronautics and Space Administration officials believe that another unmanned capsule and possibly a capsule containing an animal will be placed in orbit and recovered before an astronaut takes the orbital space ride.

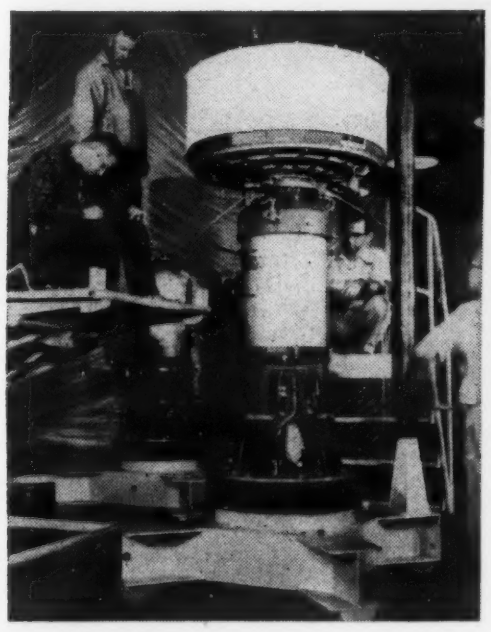
ARMY INDUSTRIAL LIAISON PROGRAM has been established for the joint purpose of providing the Army with data on industrial contractors' capabilities and of informing industry of the Army's needs for modern weapons and equipment. Army Assistant Chief of Information Gordon L. Harris is responsible for coordinating the program in which industry liaison officers work closely with the information officers of the Army area commands and with the field offices and installations of the Army's various technical services.

DEEP SPACE TRACKING ANTENNA three times the size of present antennas is planned for the Goldstone, Calif., station of the Deep Space Instrumentation Facility, which is operated for the National Aeronautics and Space Administration by the Jet Propulsion Laboratory of the California Institute of Technology. The 240-foot diameter antenna will permit the tracking of space vehicles over much greater distances than possible with the 85-foot diameter antennas now in operation at Goldstone. The larger antenna will be most useful in tracking vehicles used in the advanced programs associated with manned flight to the moon, NASA believes. The Blaw-Knox Co., Blaw Knox Equipment Div., will conduct a feasibility and design study relating to the antenna program. This study is expected to be completed by July 1962. The planning schedule calls for the 240-foot diameter antenna to be in operation by January 1965.

(*Continued on page* 23)

communications requirements for weather satellites





Tiros satellite and third stage are checked for fit.

July 12, 1961 launch of Thor Delta which placed Tiros III into orbit.

BY

BRIGADIER GENERAL NORMAN L. PETERSON

Commander, USAF Air Weather Service

ONE OF THE MAJOR limitations in the study, observation, and prediction of the earth's weather for many years has been the inability of meteorologists to observe general weather patterns and measure associated phenomena from a great distance (outside the atmosphere) where large areas could be viewed at one time. The meteorologist has had to rely on surface-based observations at separate points and translate this information to assumed continuous patterns designed to represent the actual continuous motions and activity of the atmosphere. An additional disturbing fact has been that our most sparse observational data have been from over water and ice areas which constitute by far the greater portion of the earth's surface. Ironically, it is over these areas where most of our air masses originate.

The meteorological satellite offers us for the first time an opportunity to view the weather from outside the atmosphere. Pictures taken by the TIROS satellite, from a meteorological point of view, have given some idea of the degree of resolution obtainable from the wide angle lens camera. They have shown clearly the Gulf of Lower California and a cloud mass off-shore over the Pacific. Another picture taken over the Gulf of Mexico showed rather well the cloud structure of a tropical storm near the Yucatan Peninsula.

While the initial success of meteorological satellites has excited the imagination of the weatherman, it is premature to state that the meteorological satellite will revolutionize weather forecasting. Rather, meteorological satellites do promise to become revolutionary observing systems. Immediate improvement can be expected in weather analyses over the *vast areas* where few current observations are available. Basic improvements in forecasting will evolve only after a careful study of cloud pictures, radiation data, and other measurements. An increased understanding of atmospheric processes from these studies is expected to contribute to the solutions of some forecast problems.

Communication of Data

The success of the satellite has been reasonably established. Ground processing of data is in the process of being automated. We know where and how we want to use the data. The problem is going to be getting the data to the data processing system and then to the operational forecaster while it is still useable.

Perishable Weather Data

As in the past, the weatherman, both military and civilian, is faced with the problem of perishable weather data. To the military meteorologist this is particularly acute as the U. S. Air Force increases the scope of its operations to hemispheric proportions and upward within aerospace. The increased speed and range of aircraft and missiles are placing stringent requirements for accurate and timely weather support to be available on demand for any and all areas of interest.

One of the major USAF weather centrals today processes some 50,000 observations daily of various meteorological measurements. This amounts to about 550,000 five-number groups of weather data being received in a 24-hour period. Processed data (forecasts and analyses) are used and transmitted out of this same central to other using agencies on a similar daily basis. We have many full-time communications channels devoted to conveying all this information. Meteorological satellites will multiply our existing problems of data handling and movement. Within the next several years we would expect to see several meteorological satellites in orbit at once, each faithfully transmitting vast amounts of data. Our anticipated problem here is to have sufficient high quality communications to move rapidly large volumes of data to central points for processing, integration, and further distribution to the operational forecaster.

Feasibility of Observing and Communicating Cloud Cover

The experimental satellites launched to date have been placed in an inclined orbit of about 48° so that the satellites traversed only that portion of the earth between 48° N and 48° S. The satellites were spin-stabilized to maintain a constant attitude in space, causing many

cloud pictures to be unobtainable simply because the camera wasn't pointing toward the earth at all times.

The purpose of the first three launches was to determine the feasibility of observing cloud cover and electromagnetic radiations and then communicating the information to earth. Initially, processing methods and communications facilities used were not designed to meet operational requirements. Operational application of the cloud picture data was incidental to the experiment. However, once the success of the experiment became apparent, attempts were made to improve processing and data handling techniques so that more operational use could be made of the data.

During the life of the TIROS II, for example, command and data acquisition stations were located in California and New Jersey. Facsimile was used to relay data from these stations to the central processing point in Washington. Here it was processed and disseminated by facsimile and teletype to civilian and military forecasting offices. Processed cloud picture data (nephanalyses) were received by the field forecaster on an average of seven hours after read-out time. Although delays of this magnitude are unacceptable on a continuing basis, the whole exercise was useful in helping us identify and resolve problem areas in moving and processing data.

Beginning sometime in 1962, the Nimbus type satellite will be launched. This vehicle will be earth-oriented so that its cameras always will be pointed toward the earth. It will travel in a circular orbit at an altitude of 600 nautical miles. The satellite will be launched so that the plane of its orbit will always include the earth-sun line. Launch time will be chosen so that the satellite will always pass over the equator going northward at local noon. Its period will be 108 minutes. A satellite in this so-called polar orbit can provide global observational coverage on a daily basis. I think it is interesting to note that the total amount of informational bits generated by a Nimbus type vehicle during the period of one orbit would approximately equal the total weather traffic moved over all landline circuits in the United States in a 24-hour period.

Inability to use a Single Read-out Site

Ideally one read-out station located north of the 82° latitude line (area around the North Pole) can acquire the data from all polar orbital passes without requiring more than one orbit of storage in the satellite. However, the only possible sites N of 82° are in extremely hostile climatic regimes. The extremely difficult logistical problems, additional cost of building, and the problem of establishing necessary reliable, wideband communications between that location and the United States, preclude the plan to use a single read-out site. In retreating to lower latitudes several read-out sites are required and must be strategically located to allow all data to be acquired without requiring extra orbit storage on the satellite.

The effective time for signal acquisition and tracking is limited by the time the satellite is in the direct line of sight. The Nimbus satellite must be at least 5° above the horizon (in relation to the antenna receiving dish) for at least 10 minutes so that all read-out data can be unloaded and command instructions can be transmitted as necessary. For a satellite in a 600 nautical mile orbit, the effective acquisition time corresponds to a range of 1200 nautical miles for each acquisition station.

Requirements and Capabilities of Stations

Probably three data acquisition stations will be established in northern latitudes (below 82°N) to reduce the loss of read-out data to a minimum. One or two of these locations will also be command stations to relay instructions to the satellite.

The command and data acquisition stations are responsible for acquiring the meteorological and engineering data from the satellite, recording the data, and transmitting them to a central processing point. Additionally, the station must command the satellite to perform certain required functions. The station complex consists of a large high gain antenna (60-85 feet in diameter), highly sensitive receivers, data converters and recorders, transmitters for commanding the satellite, equipment for on-site presentation of some of the data, and special equipment for transmitting the data to the designated central processing point.

Types of Data Anticipated

Initially, we expect the following types of data to be obtained from the Nimbus type satellite:

A. Orbit and position data which locate the satellite in three-dimensional space (longitude, latitude, and altitude) at the time other data are taken; and attitude data which indicates the direction of view of the sensors in the satellite.

B. TV and pictorial data.

C. Radiation data, which will include a series of measurements in a variety of spectral bands within the ultra violet, visible, and infrared spectrums.

Video information is obtained by direct link television or by read-out of magnetic tape storage devices. It is also feasible to use other methods such as flying-spot recorders or electrostatic tape which will produce recordings comparable to photographic or tape storage. Radiation data will be telemetered to the same stations as the television data and will be recorded on magnetic tape or equivalent media.

For orbit computations it will be required that all orbital data be transmitted to a central point for reduction and processing to obtain accurate determination of the satellite location. Sensor data (such as cloud cover) will be recorded first by the television camera, transferred to tape storage, or transmitted directly to the ground receiving station. After processing, it must be communicated through our weather centrals to our operating units.

Preliminary computations indicate that communications channels from the read-out stations to a central processing point in the Washington, D. C. area will require a 150 kc band width for full fidelity transmission of the video information on a near real-time basis. Later, we expect this band width will have to be doubled when two satellites are in orbit concurrently. However, it is possible that future developments may permit considerable automated processing of the video data at the read-out station. If this occurs, lower quality communications channels could be used. Considering the volume, cost, and importance of the satellite data, some sort of back-up facilities should be available to avoid loss or delay of information. This is under study now.

Cloud Observations

Initial operational data will probably be limited to daytime (Vidicon) and nighttime (IR) cloud observations. The signal from the daytime cloud observing subsystem will be received at the processing center and stored on magnetic tape. Simultaneously, the signals will be converted to visual form and to digital form. Prints will be prepared from the video signals. The quality of these signals will depend on the capability of the satellite sensory system and the communications

links from the command and data acquisition stations. Digitized data will be used to obtain machine prepared general cloud analyses for further experimental research and operational application.

Nighttime cloud observations sent to the central processing point will be coded for input to a computer system for automatic processing.

Research is underway to develop other devices for satellites which will measure additional elements of interest to the meteorologist. Of course, as more devices are added, there will be a corresponding increase in data flow through the data acquisition station to the central processing point. Depending on how additional data are integrated into daily meteorological forecast operations, there will probably be some increase in traffic from the central processing point to the using forecasters.

Expectations and Needs

As we look into the future, the meteorological satellite will evolve into an operational vehicle routinely providing global observations on a daily basis. It will travel around the earth in less than two hours, continuously acquiring data from the areas it traverses. High speed computers will be extensively used to process the vast amounts of data. The efficiency of the over-all system and the value of the derived information to the users will depend primarily on the ability of the communications system to move the traffic.

An adequate communications system which will enable us to collect, handle and disseminate all vital meteorological information in a timely manner must be provided if we expect to fully exploit the capabilities of the meteorological satellite.

Teaching Machines

(*Continued from page* 11)

detailed and practical information: programmed instruction and teaching machines.

The last field to be developed from a marketing standpoint will, paradoxically, be our own educational system in the United States. The very fact that it is a good one will inhibit the immediate widespread introduction of teaching machine techniques and devices. Our educational system is well developed and therefore tends to be conservative and idealistic in nature. Even though it faces the critical problems of rapidly increasing enrollment and a corresponding lack of teachers, a need to teach new and more complex material at an earlier age and in a more thorough manner, and even though the results of controlled experiments on programmed instruction have been exceptionally promising, there is a natural tendency when faced with a near impossible task to regress to well understood and accepted methods. Even though one is losing ground steadily, it is a predictable and understood situation that can be rationalized. We are faced with the time honored problem of "the sins of commission" versus "the sins of omission."

We envisage a gradual buildup in response to the promise of "teaching machines" in the United States educational system, starting with workshops to supplement present course curricula. Initial acceptance even in this area will most likely be in the application to foreign-language teaching where the need for both audio and visual presentation of programmed instruction has obvious acceptance.

An assessment and realization of the above markets has recently led to the agreement by Litton Industries and Prentice-Hall Inc. to jointly develop, produce and market teaching machines and related educational materials. Under the agreement, Prentice-Hall, an international leader in school textbook publishing, will develop programmed educational material designed for use with teaching-machine devices. Litton Industries will design and build teaching machines whose cost and performance are optimized for the educational materials and the user intended.

Not Replacement for Teacher

I would like to emphasize two concepts that I emphatically believe in; namely:

(1) The teaching machine will *not* replace the teacher. It provides for supplementary aid in a form closest to that of an actual teacher and will free the teacher for the creative and inspirational developments enjoyed in the normal and highly desired teacher-student relationship.

(2) There is no single unique type of teaching machine just as there is no single unique teacher. There will be a variety of classes of machines and it is the intention of Litton-Prentice-Hall to conduct their market research so as to give special weight to the needs of the educators. Just as there is a need for a family of cars ranging from the Compact to the Ford to the Cadillac, there will be a range of needs in the teaching machine field. Initial requirements will emphasize simplicity and reliability consistent with the needs for easy and flexible presentation of good and sound programmed material. Later, the need for lowering the cost of teaching machines will be felt, regardless of their initial "class" cost, be it $20 or $5,000 per machine. We anticipate a reduction in cost by a factor of two or more when large-scale production is practicable.

The Litton-Prentice-Hall time scale in the development of teaching machines and programmed material is as follows:

(a) To continue planned modifications of present Applied Communicaton Systems equipment (using slides and tape deck) to meet a wider range of industrial and military applications. These modifications will be directed toward easier and more flexible operation as well as increased reliability.

(b) To bring out a new audio-visual model of the Applied Communication Systems equipment using film strip and tape deck for foreign language teaching applications and for increased industrial and military applications. The principal aim here is to provide a larger-capacity but compact-library of visual information on an economic basis. Work is progressing on the audio-visual language teaching machine. Research models of this machine were made available last month for evaluation by experimental groups that are conducting research in audio-visual language instruction. The results of these evaluations will determine when production models will become available.

(c) To bring out, by April 1962, a modular type of teaching machine that has a basic, simple configuration for presenting visual information. This device will have provisions for adding an audio plug-in unit, and additional computing capacity to accommodate both Skinner and Crowder type programs.

In the area of military and defense applications we are programming assembly, maintenance, operation and overhaul material for use overseas in the NATO F-104 German Program. We have also held discussions in Washington on the potential value of programmed instruction in the Peace Corps and other State Department programs.

thermionic POWER becomes of age

by LAWRENCE T. SULLIVAN, Manager of Finance & Marketing, Thermo Electron Engineering Corporation

FOR THE PAST SEVERAL years whenever discussions have turned to the exciting new field of direct energy conversion, the participants have usually assumed that thermoelectric generators, fuel cells, thermionic converters and magnetohydrodynamic generators were for very futuristic applications. Today, however, one of the direct energy conversion devices, the thermionic converter, has suddenly become of age.

Examination of recent developments indicates the arrival of thermionic converters as a practical power source. NASA's Jet Propulsion Laboratory (JPL) recently awarded a contract to Electro-Optical Systems, Inc. and Thermo Electron Engineering Corporation to develop a 130-watt solar thermionic generator. JPL has plans for employing this generator in Mariner type space vehicles. Aeronautical Systems Division, Air Force Systems Command, located at Wright-Patterson Air Force Base, has contracts with both General Electric and the Thompson Ramo Wooldridge-Thermo Electron team to develop solar-heated thermionic generators. The U. S. Army Signal Corps recently let a contract to Atomic International for the development of a 100-watt gasoline-heated thermionic generator to be used as a source of power for manpack radios and radar sets. American Gas Association has a contract with Thermo Electron for the development of a 200-watt gas-heated thermionic generator. These programs point to a belief that thermionic converters are a practical source of power.

Principle of Thermionic Emission

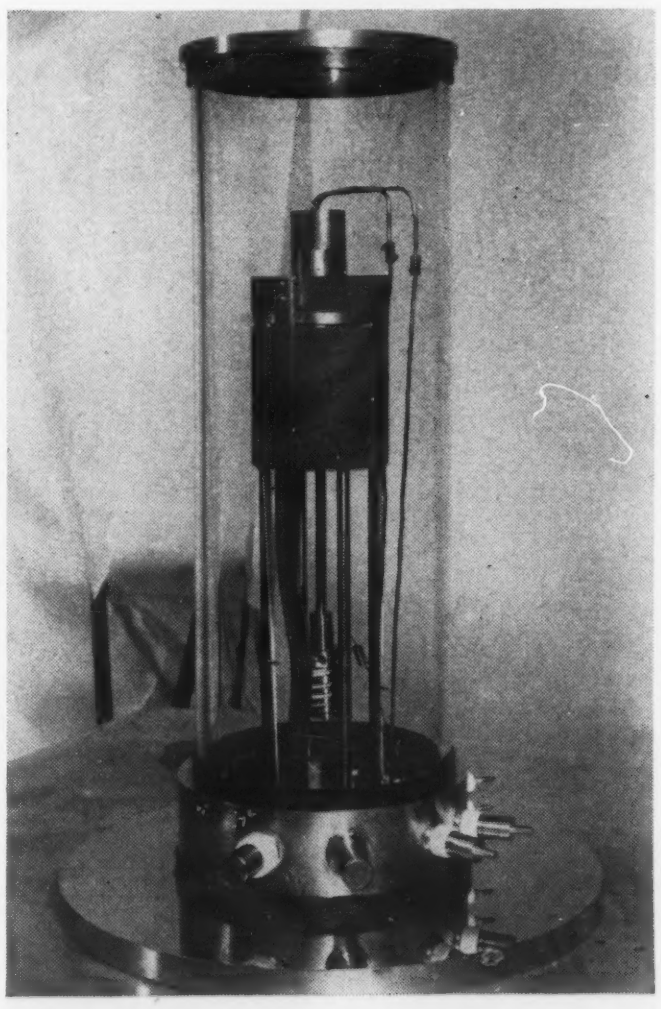
The thermionic converter operates on the principle of thermionic emission or the Edison effect. Edison's experiments in the late nineteenth century indicated that a current will flow between an incandescent filament and an independent cold electrode when the cold electrode was made positive to the hot filament. He also observed that a small current was obtained when a negative potential was applied to the cold electrode. The thermionic converter is based on the assumption that current should flow even when no potential is applied to the cold electrode, since current is observed to flow with either a positive or negative potential.

Original analysis of the thermionic converter was performed by Dr. George N. Hatsopoulos and the late Joseph Kaye of M. I. T. in 1958. This analysis concluded that the current density was effected primarily by the emitter or hot electrode temperature, the electron cloud or space charge barrier existing between the electrodes, and the collector work function (which is a measure of the relative ability of a material to emit electrons when heated to a high temperature). A very efficient converter must have a low collector work function, virtually no interelectrode space charge and small conduction and radiation losses between the emitter and collector in order to produce high power densities at high efficiencies.

Two Ways of Meeting Requirements

Two approaches evolved to meet the requirements of a highly efficient thermionic converter. Hatsopoulos and Kaye pioneered the concept of placing the emitter and collector very close together (less than a thousandth of an inch) to reduce the space charge. Great difficulty was met in their early laboratory models in trying to achieve such close spacings. Wilson of General Electric and Hernqvist of Radio Corporation of America evolved another approach—that of introducing ionized cesium

(*Continued on page* 20)



Shown at left is a 200-watt, 13 percent efficient cesium converter.

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vapor to reduce the space charge, but this also appeared to be impractical because very high temperatures (2300° centigrade and higher) were apparently necessary. The original laboratory devices produced efficiencies in the order of three per cent versus predicted values of 12-15 per cent.

What has happened to bring the thermionic converter from the status of a laboratory curiosity to the front pages of energy conversion news?

Since then researchers have pushed converter efficiencies to actual measured values of 13 per cent. Thermo Electron's Hatsopoulos and Pezaris achieved close spaced vacuum converters able to withstand rigid environmental tests. These same two and men like General Electric's Wilson and Houston, Atomic International's Ned Razor and General Atomic's Dr. Pidd, performed experiments that led to an understanding of the effects of cesium on converter performance. Their studies revealed that cesium converters could yield high efficiencies and high power densities at lower temperatures (1700°C/Kelvin) than had been expected by using close spacing. Using a molybdenum emitter, Razor obtained power densities of 15.5 watts/cm^2. Hatsopoulos and Pezaris' converter yielded a lower 11.8 watts/cm^2 with a tantalum emitter but achieved a much longer life. More recently Brosens of Thermo Electron achieved 16.5 watts/cm^2 with a tungsten emitter.

Most researchers feel that efficiencies of 20-25% are possible in converters within the next few years. To reach practical converters at these efficiencies, they will have to find long life materials with improved thermionic properties, develop structural materials which represent the optimum compromise between thermal characteristics requirements and structural strength, and increase the ability of converters to withstand cesium corrosion over longer periods of time.

Thermionic converters are being pursued because they offer tremendous potential as a very lightweight, compact and efficient source of auxiliary power. They have a greater potential efficiency than thermo-electric generators because they operate at much higher temperatures. They are much more compact than fuel cells—in fact, one source, Paul Egli, Navy Co-ordinator, Direct Energy Conversion Naval Research Laboratory, estimates they are lighter by a factor of 80 to 1. An example of the compactness of thermionic converters can be obtained from a glance at Thermo Electron's 13 per cent efficiency, 200-watt generator developed under their Thompson Ramo Wooldridge-Aeronautical Systems Division contract. This generator weighs 10 lbs. and occupies only 40 cubic inches of space.

Power Source to Underdeveloped Nations

These attributes point to application of thermionic converters as a prime source of auxiliary power in our nation's space program. They promise to become the Army's long sought silent portable power pack. Commercially, they hold the key to the gas appliance-makers' desire to obtain freedom from dependence upon external electricity for controls and lights. Perhaps more important is the fact that thermionic converters offer a source of power to the many nations in the world which do not have utility systems developed. Wherever gas, gasoline and sunlight can be found, electricity can be obtained. Then maybe India's small villages will have another source of power besides oxen pulling a step-up gear, shaft-driven generator. Thermionic converters' greatest role may thus be to help emerging nations come of age.

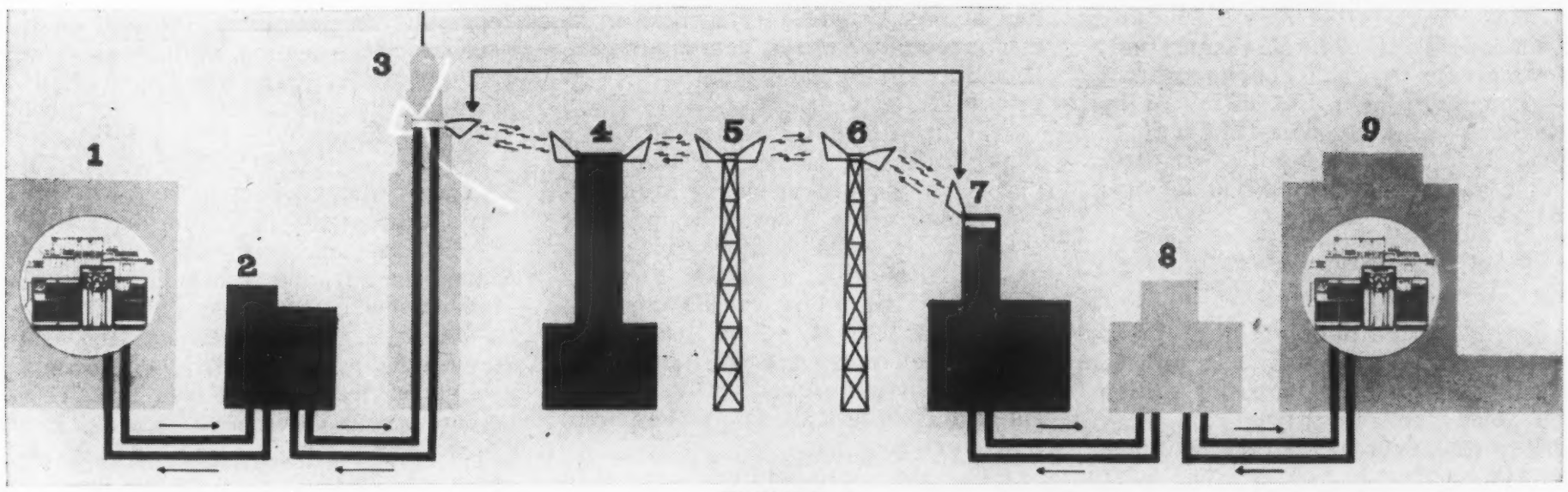

FIGURE 1

From New York City's IBM computer center at Time-Life Building (1), data flows over cable through the West 50th Street telephone central office (2) then on to the phone company's microwave transmitting and receiving center atop the Empire State Building (3). From there the data is sent by Bell System Microwave Radio to Poughkeepsie central office (7) via relay towers in White Plains (4), Pleasantville (5), and Poughquag (6). At Poughkeepsie telephone central office (7) it is transmitted by cable through IBM's South Road Labs (8) to the computer center at its Boardman Road location (9).

COMPUTERS BECOME HUMAN

by W. J. BAIRD, Editor, SIGNAL

MODERN TECHNOLOGY has made it feasible for a computer to talk with a computer on a reliable and economic basis and with amazing speeds and accuracy. For the first time, as demonstrated recently at the IBM Computer Center, Time-Life Building, New York City, information can now be transmitted at the full speed and capability of the computer itself. In other words, the operating speed of the computer is the final determining factor. The new system came about as a result of merging an IBM Tele-Processing System installation which permits IBM to transmit data between any two points at 15,000 characters (105,000 bits) per second and the New York Telephone Company (Bell System) High Speed Microwave Data Transmission System. When workloads justify it, the transmission rate can be increased from 15,000 to 62,500 characters (437,000 bits) per second. This is roughly seven (7) full-length novels in one minute.

Equipment Used in the System

The Tele-Processing system has at each location the new IBM 1945 magnetic tape transmission unit, which permits the high transmission rate. Also, at each location there is a standard IBM 1401 intermediate-sized computer operating in conjunction with the 1945. In addition to its computing ability, the IBM 1401 can print at 600 lines per minute, read cards at 800 per minute, and punch cards at 250 per minute. Each of the 1401's is equipped with two magnetic tape drives. The over-all transmission network operates under the control of a stored program in the 1401 memory.

This equipment gives IBM great flexibility and enables them to transmit information at very high speeds in either or both directions simultaneously.

How the Data Travel via the Telephone Cable and Microwave System Between New York City and Poughkeepsie, N. Y.

According to Mr. Walter A. Giles, Vice President, New York Telephone Company, the High Speed Transmission system works as follows. From the IBM computer center at Time-Life Building, (see 1 of Figure 1) data flows simultaneously over seven parallel channels through the West 50th Street telephone central office (2) on to the phone company's microwave transmitting and receiving center atop the Empire State Building (3). From there the data goes by microwave radio to the Poughkeepsie telephone central office (7) by way

FIGURE 2

This IBM computer center in New York City is linked to another data processing facility in Poughkeepsie, N. Y., 68 air-miles away, by an ultra-fast communications system. Information to be processed is transmitted in either direction—or both ways at once—more than 1,000 times faster than human speech. The communications link utilizes a specially-developed IBM 1945 magnetic tape transmission unit (left) at each location, telephone cable and a Bell System microwave radio network.

of relay towers in the New York State communities of White Plains (4), Pleasantville (5), and Poughquag (6). At Poughkeepsie it is transmitted by telephone cable through IBM's South Road Labs (8) on to the computer center at its Boardman Road location (9).

What's So Unusual About This Communications System?

Speed and flexibility of the system are unusual. The system can provide additional channels. One is for written and voice communications; the other verifies that data has been received at the far end.

By far one of the most advantageous accomplishments has been the elimination of physical distance in data processing. In other words, computers have been brought to the people—wherever people are located.

Warren C. Hume, President of IBM's Data Processing Division, pointed out that such modern speed of transmission would allow a large company or organization to distribute various jobs among its multiple computer facilities without regard to physical distance. He stated that "For all practical purposes, any and all computers tied in to the communications network could be considered as accessible as if they were under one roof."

Using 1945 units and telephone data transmission facilities, a company or organization can merge its far-flung computer installations. Information — commercial, scientific, military—can be transmitted at great speed and in tremendous volume from a 1945 equipped with a 729 tape drive to a solid-state computer equipped with a 1945. For example, data collected in New York can be processed in California, just as if the electronic processor were in the same room rather than thousands of miles away.

Mr. Giles in conference stated that the High Speed Digital Data Transmission System is really a data link. It is a go-between — a connecting link — a broad band circuit using seven channels. It can carry data as fast as business machines can produce it. In its application it can be connected to a computer in San Francisco, Dallas, Milwaukee, Dubuque, or wherever IBM chooses. He stated also, "We can also meet the data carrying needs of all other customers, large or small, down to the small business with only occasional data transfer requirements."

Are Communications Systems of This Type Used Exclusively with Computers?

No indeed. The telephone company provides communications services of many types. These vary from the very slow speed requirements of telegraph services to the very high speed facilities provided for television networks. One communications service recently developed by the Bell System is TELPAK. This leased-line service provides communications facilities for handling a variety of customer needs. These include telegraph, teletypewriter, handwritten, voice, facsimile, computer-to-computer, and magnetic tape to computer data services. TELPAK is designed especially for companies that have large volumes of communications between specific locations. Of the lesser speed facilities, the New York Telephone Company offers a variety of DATA-PHONE services which transmit over the regular nationwide telephone network at speeds up to 2,000 bits a second. DATA-PHONE services are versatile and flexible—designed to meet the various needs of today's business.

How Much Data Is Being Sent Over Telephone Lines Today?

At present a relatively small amount. But the volume is increasing constantly. Today, some major airlines actually print tickets over telephone connections. A midwestern insurance company renews policies, changes addresses. and records premium payments by sending data over regular telephone channels. A New York City bank obtains daily payment data from its six branches over conventional telephone facilities. Frederick R. Kappel, Chairman of the Board of the American Telephone and Telegraph Company, has predicted the time will come when machine-to-machine talk over communications channels will equal (and maybe exceed) in sheer volume human talk over today's telephone network.

CAPE CANAVERAL LAUNCHING SITE will be enlarged so that manned lunar flights and other missions requiring advanced Saturn and Nova-class boosters can be launched from the Florida site. The decision to expand the Cape is tied directly to national space goals spelled out by President Kennedy earlier this year. National Aeronautics and Space Administration plans call for the acquisition of approximately 80,000 acres north and west of the present Air Force Missile Test Center. The land will cost an estimated $60 million. The projected Cape expansion will permit construction and operation of six or more large Saturn and Nova-class launch vehicle complexes. Engineers estimate that Nova vehicles, which provide as much as 20 million pounds' thrust in the first stage, will require protective land radii of up to 10 miles. If flight test work on the large booster vehicles is to meet lunar flight dates targeted for the late 1960's, engineers believe the launch complex construction should be started in six to twelve months.

NAVY SHIP FOR ADVENT USE will be the USNS Kingsport Victory, a victory ship now undergoing conversion work. The Navy awarded a $2.4-million contract to the Guy F. Atkinson Co. to convert the victory ship, now a part of the Military Sea Transportation Service Active Fleet, to a satellite communication ship for Project Advent. Expected to be completed by April 1962, the conversion will consist of installing additional berthing, messing, shop and office spaces and installation of ship-to-shore communications, additional electric power generating equipment and a helicopter landing platform.

CONTRACTS: ARMY: Philco Corp., Communications Systems Div., design, engineering and installation of a communications system providing voice and teletype transmission by means of multiplexing techniques on a wide-band radio system, $4.7 million; Harrington & Richardson, Inc., production of M-14 rifles and repair parts, $3.6 million. NAVY: Ryan Electronics Co., production of airborne continuous wave Doppler navigation systems, $8.3 million; Electric Storage Battery Co., production of submarine batteries, $7.5 million; Polarad Electronics Corp., production of single sideband ship-to-shore transceivers, $4 million. AIR FORCE: Bendix Corp., design production and testing of prototype for rocket-borne communications system, $8 million; General Telephone & Electronics Corp., engineering and production of receiving equipment, $2.1 million; Collins Radio Co., production of airborne transceivers for use in Strategic Air Command aircraft, $1.5 million; Ling-Temco Electronics, Inc., reconditioning and modification of C-133 transports, $1.4 million.

—INDUSTRY—

FLOATING NUCLEAR POWER PLANT will be capable of supplying the electrical needs of a civilian community of 20,000 in a peacetime disaster or wartime action. The nuclear plant, which will be designed and built by Martin Co. under a $17 million contract from the Army Corps of Engineers, will be housed in a reconditioned and rebuilt Liberty ship, the Walter F. Perry. The ship would be towed from place to place as needed. The final design for the power plant is expected to be completed late next year; construction and all test phases will require an additional 36 months. The work is tentatively scheduled for completion by the end of 1965.

ELECTRONIC MESSAGE DISTRIBUTION SYSTEM which is said to eliminate a bottleneck in military communications has been developed for the Army Signal Corps by Minneapolis-Honeywell Regulator Co. Resembling a large digital computer, the system automatically sorts and processes incoming teletype messages. It can reduce from hours to a few minutes delays previously encountered, Minneapolis states.

PHILCO CORP. will become a wholly owned subsidiary of the Ford Motor Corp., under an agreement signed last month by the directors of both firms. The acquisition will enable Ford to broaden its operations and contribute more to the national defense.

ELECTRONIC FABRICATION LABORATORIES, Electronic Control Products Div., will provide a transmitter-receiver system for use in controlling the refueling complex at O'Hare International Airport in Chicago. The company's Mark IV Supervisory/Control System will be used to send information at the rate of 360 bits per second over a single pair of telephone lines from nine pumping stations to a control house. The information will indicate fuel levels, pressure and pump status. The Mark IV also will provide a constant check on the over-all function of the entire area so that affected areas can be shut down in case of fire or other emergency. The Mark IV is a tone-modulated carrier transmitter/receiver connected to a unique scanning device.

(*Continued on page* 25)

FIRST SIMULATOR OF AF F-105D fighter-bomber has been delivered to the Tactical Air Command by ACF Electronics, a division of ACF Industries, Inc. The electronic flight and tactics device will be used for training TAC student pilots. The 16-ton simulator consists of a cockpit and instructor-operator console, a map room and two lines of back-to-back computers and allied equipment.

CONTINENTAL ELECTRONICS MANUFACTURING CO., subsidiary of Ling-Temco Electronics, Inc., will build a power supply for the Argonne National Laboratory's 12.5 billion electron volt proton synchrotron. Considered one of the world's most powerful nuclear research devices, the proton synchrotron will enable scientists to experiment with known atomic phenomena and to discover new phenomena occurring when high energy protons collide with other protons at rest. The Continental contract provides for the fabrication of a programmed, regulated direct current power supply with a maximum output of 500,000 watts. This power supply will produce the direct current voltage for a continuous wave frequency modulated transmitter with the function of accelerating the beam of protons in the synchrotron to nearly the speed of light.

RFI CONTRACT to design and study the feasibility of a simulation testing facility has been awarded to Radio Corporation of America under the Department of Defense Radio Frequency Compatibility Program. This program will coordinate the activities of the military services in minimizing radio frequency interference problems and in achieving improved radio frequency compatibility of equipment and systems. The RCA feasibility study will be made to evaluate the compatibility of electronic equipment in specified electromagnetic environments. The testing facility will perform on data obtained through measurement programs and processed by an electro-magnetic compatibility analysis center recently implemented by the Defense Dept.

OPTICAL MASER USING HELIUM AND NEON to produce a 1.15 micron wavelength continuous infrared beam has been developed by Raytheon Co. The gas maser is built in a low-expansion Invar-rod frame, weighs about 35 pounds and is mounted together with the vacuum and gas handling systems on a laboratory table.

COMPUTER CONCEPTS INC. is a new company which will develop and sell advanced programming systems for high speed digital computers. Located in Washington, D. C., the firm will provide services ranging from a feasibility study of a company's use of computers to the development and distribution of standardized computer programs with application for wide generalized areas.

INFRARED DEVICE for measuring minute changes in temperature will be produced by Hughes Aircraft Co. for the Bureau of Naval Weapons. The work is being done under a $1.8 million contract. The device is so sensitive that it has measured the cooling of the moon during a total eclipse, the Defense Dept. reports. Operating at 452 degrees below zero Fahrenheit, the detector incorporates a miniature refrigerating device which uses liquid helium as the refrigerant. The cooling unit, a cryostat, weighs 27 pounds and has a volume of less than one cubic foot.

ELECTRONICS ATC SYSTEM which would reduce the delays in approaching and departing the major air terminals of the nation has been proposed to the Federal Aviation Agency by Motorola Inc. and General Precision Inc. The new system, entitled ACCESS (Aircraft Communications Electronic Signaling System), utilizes existing communications facilities by "time sharing" the voice radio channels with electronic digital communications. With the new air traffic control system, all routine communications such as aircraft identification, weather information, and flight clearances would be handled electronically with the push of a button. Thus, the present number of voice communications required on a flight would be more than cut in half.

—GENERAL—

WORLD'S FIRST ISOTOPE-POWERED AUTOMATIC WEATHER STATION will soon go into operation in the Canadian Arctic, according to an announcement from the Commerce Dept. The unmanned station will operate for about two years. Power to operate the station will be provided by an isotope of strontium-90. The station and power source are housed in a cylindrical, insulated container approximately eight feet long. The lower five feet will be buried in the permanently frozen ground of the Arctic. Instruments will measure wind direction and speed, temperature, and barometric pressure, and feed these readings into a data processing system from which they will go to the station's radio transmitter for relay every three hours to permanent weather facilities further south. The station is the result of cooperative scientific work of the U. S. Department of Commerce Weather Bureau, the U. S. Atomic Energy Commission, and the Department of Transport of Canada.

INTERNATIONAL WEATHER SATELLITE WORKSHOP in Washington, D. C., will be the scene of discussions on the engineering aspects of Tiros weather satellites, significant research results, the data acquisition system, and the program plans for future meteorological satellite systems. The workshop, to be held Nov. 13 to 22, 1961, is being arranged by the Department of Commerce Weather Bureau and the National Aeronautics and Space Administration. More than 100 nations have been invited to send representatives to the ten-day meeting.

DEFENSE DEPT. RFI MATTERS will be discussed and problems pertaining to the DOD Electromagnetic Compatibility program will be outlined at the Seventh Conference on Radio Interference Reduction and Electronic Compatibility to be held in Chicago at the Illinois Institute of Technology, Nov. 7-9, 1961. Emphasis will be placed upon the analysis requirements of the DOD Electromagnetic Compatibility Analysis Center being implemented at Annapolis, Md. Also included in the program will be sessions on design and measurement techniques, data processing and display methods, interference prediction techniques, and practical interference control and reduction. Sponsored jointly by the three military services, the conference will be conducted by the Armour Research Foundation in cooperation with the Institute of Radio Engineers.

WEST COAST ELECTRONICS INDUSTRY is continuing to grow and the 11 western states now account for one fourth of the total electronic sales and employment in the United States, according to the Western Electronic Manufacturers Association. Employment in western companies has reached 215,000, which is 24.6 percent of the total U. S. electronic manufacturing employment, and electronic sales in the west this year should climb to $2.8 billion, which is 24.9 percent of the national total. These figures are based on the annual WEMA survey of the western electronics industry, including detailed reports from the trade association's 320 member companies.

CHICAGO'S LACK OF R&D WORK has accounted for some of the area's failure to recruit and retain outstanding researchers and scientists, according to a report prepared by Northwestern University professors for presentation at the National Electronics Conference, Oct. 9-11, 1961, in Chicago's International Amphitheatre. This lack of emphasis on research and development is due in part to the lack of adequate programs with local universities for company-sponsored advanced degrees, cooperative research projects, and participation in research seminars, the report says. Deficiencies in electronics research in the areas of solid state components, data processing, microwave systems, weapon systems, command and control systems, and sophisticated instrumentation are cited in the report. The R&D study was initiated by the Institute of Radio Engineers' Professional Group on Engineering Management, sponsored by the National Electronics Conference and supported by grants from more than 25 Chicago electronics firms.

COMMERCIAL TRANSPORT AIRPLANE which could fly three times the speed of sound could be built by 1971, and there would be a world market for more than 200 such planes. These are the conclusions of a booklet, "Commercial Supersonic Transport Aircraft Report," issued by the Federal Aviation Agency, the Department of Defense and the National Aeronautics and Space Administration. The report notes, "The B-58 and the B-70 bomber programs and broad earlier research and experience of supersonic flight from which they evolved provide the United States with a unique capability for developing a supersonic transport." Private industry, the report adds, cannot at present finance the job alone but will need Government assistance. Research on various parts of the project already is under way by FAA, DOD and NASA.

COMING EVENTS:

OCT. 9-11: Industrial Film & A-V Exhibition, presented by Industrial Exhibitions, Inc., Barbizon-Plaza Hotel, New York City.

OCT. 9-11: National Electronics Conference, sponsored by American Institute of Electrical Engineers, Illinois Institute of Technology, Institute of Radio Engineers, Northwestern University and University of Illinois, International Amphitheatre, Chicago, Ill.

OCT. 19-20: Midwest Quality Control Conference, sponsored by American Society for Quality Control, Chase-Park Plaza Hotel, St. Louis, Mo.

OCT. 20: Electronic Reliability Conference, sponsored by Institute of Radio Engineers, New York University's College of Engineering, University Heights.

OCT. 23-25: East Coast Conference on Aerospace and Navigational Electronics, sponsored by Institute of Radio Engineers, Lord Baltimore Hotel, Baltimore, Md.

OCT. 24-26: International Symposium on Aerospace Nuclear Propulsion, sponsored by Atomic Energy Commission, National Aeronautics and Space Administration and Institute of Radio Engineers, Riviera Hotel, Las Vegas, Nev.

OCT. 30-NOV. 1: Radio Fall Meeting, sponsored by Institute of Radio Engineers and Electronic Industries Association, Hotel Syracuse, Syracuse, N. Y.

the visible deterrent

by

MAJOR GENERAL HAROLD K. JOHNSON

Commandant

U. S. Army Command and General Staff College

Fort Leavenworth, Kansas

IT IS DIFFICULT to quarrel with the credibility of an armed guard at your front gate, or at your front door, or sitting in your living room. The Army today is an armed guard positioned at danger points around the world for the explicit purpose of preventing intrusion into your living rooms.

However, I have no intention of expanding or elaborating on service divergencies. War today is a team affair. Each service has a role to perform, and each element that constitutes the respective services contributes to the fulfillment of a particular service role. I think that it is only natural that there be differences of opinion. There is no fundamental disagreement on the basic point that our country must be strong. There is a general recognition that the resources of the United States are not unlimited. I deliberately choose a double negative to highlight the fact that there are limits on the percentage of national treasure that we can commit to the preservation of freedom, if we are not to negate the elements of freedom that we profess to protect. There are, of course, a great variety of opinions as to the composition of our total defense force. With the many unknowns and uncertainties that are associated with the new weapons that are available today, there are bound to be differences of opinion. However, it is not my purpose to provoke a discussion on this subject.

First, I want to establish myself as an expert of sorts, without vanity, and in all humility, to provide a point of departure for what follows. Second, I want to review briefly the Army's role against a backdrop of the past 25 years of history. These past years are tending to bring into perspective the kinds of forces that are required to preserve and protect those principles upon which this Republic was founded, and which we now are confronted with accomplishing. And finally, I want to cover three specific areas in which the Communications and Electronics industry can contribute to a marked degree in improving the ability of the Army to accomplish the tasks that have been assigned to it.

First, to establish myself as an expert. This condition derives from my assignment as the Commandant of the United States Army Command and General Staff College. Most people think of a college as an institution that teaches, and so we do. All of the services have an institution with titles similar to ours. All of them teach. At Fort Leavenworth today we have 750 students in residence for a period of ten months. We have 400 students in residence for a period of 16 weeks. We have recently graduated approximately 50 senior officers who had been attending a Senior Officer Nuclear Weapons Employment Course, the eighth that we have conducted during this fiscal year. During the month of May we brought in all our reserve division commanders with their staffs for a one-week refresher course. The next week we brought in 45 logistical commands from all over the country for a week of refresher training. And during the last week in May, all of the National Guard Division Commanders and their staffs assembled at Fort Leavenworth for a week of instruction and practical map exercise work. Our in-residence student load during each year averages approximately 1250 students. We run classes all summer with a load somewhat less than the 1250 that I just mentioned. We conduct a nonresidence course of instruction that touches nearly 20,000 officers all over the world. Part of these people, nearly 7,000, are enrolled in our extension courses. We send out the lessons, grade the student's work, conduct examinations by mail, and maintain the records of these dedicated citizen-soldiers. For the balance, we provide all of the instructional material for 176 United States Army Reserve Schools all over this country and in those foreign countries where

United States forces are stationed. The material that we provide is complete, to include a manuscript for the instructor and the detailed lesson plan for each hour of instruction that he presents. This particular program has a tremendous impact within the Army structure. In addition, we maintain contact with all of our graduates and provide them with an opportunity to up-date themselves through the medium of a special extension course. Many former graduates take advantage of this program.

One element of our program has a special interest and a special impact. Last year in our student body we had 84 officers from 43 foreign countries in our regular course. Last fall we had 35 officers from 13 countries in our associate class. Last spring we had 25 officers from 12 countries in our spring associate class. Since 1908 when two officers from Mexico attended the Command and General Staff College, there have been 2,169 officers from 65 foreign countries attend our college. This particular program is one of the most effective instruments of the United States in promoting a common understanding and mutual trust and confidence between and among the allied armies of the free world. Our students are not necessarily from countries bound to the United States by treaty. For example, we had one Yugoslav officer in our regular course last year who was an extremely fine person, a forthright man, and a respected member of his class.

Strangely enough, this varied and diverse resident and nonresident student population constitutes only about 50 per cent of our workload. A major function of the college is the development of doctrine for the larger tactical units of the Army; specifically we develop how a division, a corps, and a field army fight the land battle, together with how these units will be supported logistically, or in the broader sense. administratively, to include logistics, both within the field army area and at the logistical command level of responsibility in the communications zone. Doctrine requires a little explanation and I would like to define it a little bit more precisely as follows: "In its general sense doctrine applies to any speculative truth or working principle, especially as taught to others or recommended to their acceptance."

Our doctrinal responsibility takes two basic forms. First, we are continually engaged in a wide range of exploratory studies. We have the responsibility for recommending changes in doctrine, which includes organization, as and when such change appears to be required. When our proposals are accepted, and this of course is a slow process, our second task assumes primary importance as we translate the approval into specific training literature. The college has the responsibility for the preparation of 22 separate field manuals. At the risk of over-simplification, I would sum up this particular point by saying that the Command and General Staff College is responsible for translating broad and general policy statements into practical methods and procedures to be employed in the conduct of the land battle.

Role of the Army

My second point has to do with the role of the Army. Particularly against the backdrop of the past 25 years. In 1936 our Army had a strength of approximately 165,000 men. We were just getting out of the business of running the Civilian Conservation Corps. We were testing modified organizations in order to take advantage of the improved mobility resulting from the introduction of an appreciable number of wheeled vehicles into our organizations. In 1936 and 1937, I commanded a machine gun company, later called a heavy weapons company, in the 3D infantry regiment at Fort Snelling, Minnesota. My company was equipped with mules and machine gun carts. In those years we began to displace the mule in our service company, a company that provided us with our rations and our ammunition, in favor of trucks. In 1939, the 13th Armored Brigade, the first fully mechanized unit in the United States Army, appeared in a major maneuver in upper New York State. During the early 40's the Army experimented and changed a number of divisions. We built a mechanized division but did not use it as such during hostilities. We went into North Africa with a heavy armored division and actually had two heavy armored divisions during the war, but modified other formations of the same type to a somewhat lighter structure. The proponents of each were still arguing the respective merits of these organizations in the late 40's. We developed a mountain division that fought in Italy—and effectively. Other light divisions of this type were not employed as such, primarily because of the excessive demands of infantry replacements when the fighting got heavy in Europe. Immediately following the war each combat arm conducted a major conference to bring together the many findings and experiences resulting from the war, and a new infantry division and a new armored division were tailored. The armored division developed in 1946 is still substantially the same today, with some comparatively minor adjustments resulting from the accommodation of new equipment. The post World War II Infantry Division fought the Korean War. To a degree, the attention focused on the Korean War by all of the Army, since this was really a major effort from the point of view of the Army, tended to inhibit the extent of thought and effort devoted to experimenting with combat structures that could live on a battlefield on which nuclear weapons might be employed. About 1953 a number of experiments were started with different types of structures, seeking faster moving and more responsive divisions. These experiments culminated in the adoption of the Pentomic Organization in 1956, the organization that we have today. Of course during this same period of time we have undergone a similar type of evolution with our airborne forces. As an example, we abandoned gliders and put all the combat elements in parachutes. The airborne division today has substantially the same organization and structure as the infantry division, although there are some differences in the support organization and, obviously, differences in heavy equipment.

While this evolution in our Army has been occurring, the communist empire has been expanding. In 1941 the Baltic States were absorbed. A great variety of actions during the war years culminated in the subjugation of Poland, East Germany, Hungary, Rumania, Bulgaria, Yugoslavia, and Albania in the years at the end of the war. In 1958 Czechoslovakia was subverted from within. In 1949 China began to topple until the duly constituted government was driven from the mainland of Asia in 1950. Also in 1950, the Korean War started. In 1951 the Chinese invaded Tibet, although they did not complete their subjugation until 1958. There was a continuing war in Indochina from 1946 until 1954, when the country was divided in order to reach a settlement.

Politically during this same period of time, we have entered into a series of alliances around the world

and in individual mutual security pacts. NATO was formed in 1949; SEATO in 1954. ANZUS, the Bagdad Pact, and CENTO all have come into being.

During 21 of the last 25 years, communism has been creeping. During the last 12 of these years the United States has been countering with a series of alliances and mutual defense arrangements all over the world. But only in Europe where we have Army forces positioned and in Korea where we committed ground forces against the aggression, and in a limited number of countries that have developed a reasonably sophisticated ground force, has this creeping aggression been arrested. Nowhere has it been thrown back.

The particular talents of all of the services are required to meet and to stem this tide. The Navy must maintain freedom of the seas so that our forces may be deployed without interference. The Air Force must pose a believable threat of devastating destruction if our interests are attacked or our boundaries are crossed. The Army must continue to perform its traditional role of standing among the people and defending front doorsteps, the traditional role of a protective guard at the gate—*of providing the protective picket fence.* America's gate today is as far away from our front door as we can make it, because the range of weapons and the ability to control those weapons have increased to such a marked degree over this same time period.

We have only to look at the development of our country to draw an analogy. Our country was settled behind outposts of soldiers who protected the settlers against resisting Indian tribes. As the pressure of the settlers increased, the outposts moved further west. Our forces in days past were disposed in accordance with the dictates of the range of the guns of the Redskins and their ability to move. Our forces are disposed today in accordance with the range of the guns of the Reds and their ability to move, tempered by some facts of geographic possession, and weighed against our own capabilities in the same fields. A picket fence of soldiers thwarts aggression.

Industry's Role

Now let's turn to the third point. What can you, Industry, do to improve the ability of the Army to do its job? You will frequently hear professional soldiers say that an Army must move, shoot, and communicate. I would like to make one point crystal clear, and in order to

do this we must move into an abstract area momentarily and discuss the nature of war.

I think that we could all agree, regardless of service affiliation or background or personal conviction, that the ultimate objective of war is to impose control. From the point of view of the United States, which does not have a policy of initiating war, it would be more proper to use this term in reverse. In our country we go to war to prevent someone else from imposing his control on us. To impose control, you have to close with an enemy. Now I realize that you can get an argument in this area and someone can cite the Japanese surrender as an example of not closing with the enemy in his homeland. I would suggest, however, that we had done a lot of closing prior to the final surrender. We had destroyed the cream of his army in the south and southwest Pacific. Our submarines had destroyed the bulk of his shipping, which was essential to his internal economy. When the surrender occurred, the great majority of his fighting force was no longer effective. And U.S. forces did move in to exercise control. It just happens that I was in Japan about the time that the B-29's began to bomb, and even before the extensive bombardment the general public was on a limited ration. I can assure you that I was on the same limited ration, because the first time that I could get myself to a scale after I had been in Japan for three weeks, I weighed just 92 pounds. This didn't result from over-eating. To return to the subject of imposing control, it is necessary to close with the enemy in order to impose the degree of control that is essential, if our control is to be assured.

We then move into the basic function of the Army, and this can be best expressed in the role of the infantry: "Through fire and maneuver to close with and destroy the enemy." The two basic elements, then, of ground combat are fire and maneuver. What happened to the term "Communicate" that I used a moment ago? Nothing at all. Our ability to maneuver and our ability to deliver fire is measured in terms of how each of those elements is controlled. While the personal touch is required from time to time, communication provides the primary means of control.

Now let's take a look at each of the elements of fire and maneuver. Our firepower, of course, has increased almost beyond comprehension, with the advent of nuclear and thermonuclear weapons. But we have a little problem with this tremendous firepower. Congress says that the President must authorize the first shot. How does the President get word to the men on the end of the lanyard? I think the answer is obvious — through communications. And while we are waiting for this word, we are still confronted with an enemy — at least the ground soldier is, and he must be shooting something through his gun tubes.

Battlefield Requirements

The requirements for a rifleman to have communications are relatively little. He shoots at what he sees and sometimes at what he hears. But his fire is rarely directed by someone remote from him who tells him by telephone or radio where he should shoot. Admittedly, we have been experimenting with individual helmet radios, but this is not so much from the shoot point of view as it is from the maneuver point of view. Historically, the great mass of casualties are inflicted by shell fragments. The popular term is shrapnel which, incidentally, is not quite technically correct. Shell fragments are delivered largely by indirect fire weapons, that is, weapons so located that the gunner cannot see his target. Fire is adjusted by an observer who is in a position to see the shell burst. This observer then must maintain contact with the guns or the tubes by means of communication, and here is an area where reliability is of paramount importance. Radios used by the forward observer exist in the mud and the slush and the snow and the heat and the frost for 24 hours a day. For those of you who have 18 and 19, and 20-year old youngsters, think of putting complex pieces of equipment in their hands to use, to maintain, and to protect, and think of what your own son would do with this particular piece of equipment; this is the kind of man who takes care of it. It has to withstand the thoughtless act. It has to withstand the panic act; it has to withstand the beating occasioned by the necessity for taking quick action to preserve the life of the operator. It has to be rugged and durable and reliable.

I can speak with some feeling from the point of view of an operator. The Chief Signal Officer, General Nelson, in an address before the Chicago AFCEA Chapter, made the statement that perhaps we are building too many things into our equipment. Perhaps we are, in what we expect in terms of doing a variety of things. I would caution, however, that young soldiers, hastily trained, operating in an environment that is completely strange to them and that is foreign to human nature, are the men who operate this equipment. I would point out that the lives of men, men that cannot be replaced, depend upon the reliability of the equipment. You cannot equate dollars and a man's life, and yet we tend to do this from time to time. When we provide flimsy equipment, we are sacrificing lives, in the last analysis. When you design equipment that cannot be maintained in forward areas, in cold weather, in rain, in snow, in heat, that equipment is unsatisfactory. I could cite examples from my own experience where I could charge losses in some of my units to deficient communications. Some I failed to use properly. Some were too complex. Some were not tough enough. Your job in this field is not yet done. To apply firepower promptly and properly, communications are essential.

Now, let's turn the coin and talk about maneuver for a moment. I remind you that ground soldiers are organized into squads, platoons, companies, battalions, battle groups, regiments, combat commands, and on up the line. Strangely, firepower does not kill an unusually large number of people. A great many are wounded, but even in this category, the percentage is small when applied to the total number in uniform. Of course, the closer you get to the point of engagement, the higher is the rate of casualties.

The single most precious element of combat power is the life and the energy of the individual soldier. If either life or energy is expended needlessly or carelessly, only time can restore the loss. Time just isn't available in an engagement or a fight.

Communications play a vital role in conserving our most precious resource. To close, units must maneuver. The maneuver is predicated upon what they know and what they have been told. Do they creep up on a position from the front, from one flank or the other, or both? Communication systems tell them and tell them when to change directions. When word is passed by voice, the leader frequently becomes a casualty. Some men will still have to be physically influenced to move, but the exposure time is reduced materially when a leader can use a radio. Hence, the helmet radio that I mentioned earlier.

As formations get larger, it becomes obvious that physical contact

(*Continued on page* 32)

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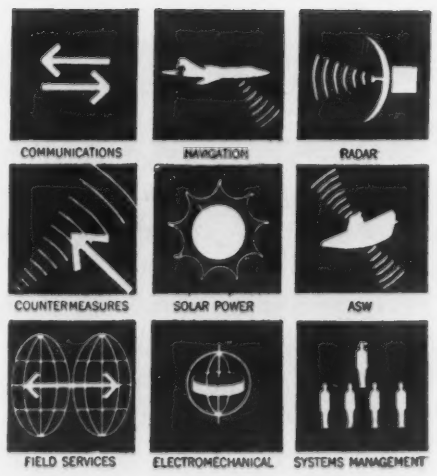

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Military Products Division

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SIGNIFICANT DEVELOPMENTS AT HOFFMAN HAVE CREATED POSITIONS FOR SCIENTISTS AND ENGINEERS OF HIGH CALIBER, PLEASE ADDRESS INQUIRIES TO VICE PRESIDENT, INDUSTRIAL RELATIONS

is impractical as a general rule. As a consequence, orders flow one way and information flows the other way over communication systems. In this environment, the requirement for something light, durable and reliable transcends the requirement in the firepower side of this equation. In the maneuver element you find the dirtiest, most disliked task of all—the task of being a target. We have no civilian occupations that train a man for that. The forward elements can stand some help. As an example, I have a terrific allergy to antennas. I've been the object of considerable attention as a result of an antenna identifying my position. An antenna means a commander of some kind. Knock him out if you can.

Our frequencies are cluttered. Everyone wants to talk. Instill some communication discipline, you say. Try it sometime, in the heat of battle. In addition, the frequency spectrum we use is subject to jamming. Somewhere in this great universe there are some spare frequencies floating around.

New Requirement

A new requirement, not really new but one that is just now getting extensive attention, derives from two factors. We have this tremendously increased firepower. We have an ability to move by a variety of means, on foot and in carriers, perhaps even armour-protected under some conditions. We have helicopters. We have large aircraft to move units and their equipment between theaters. As we improve our ability to move, we deny ourselves time. When we have so little time, we have got to know where the enemy is, how much, how big, where he is going. Now, traditionally, since the day of the first scout—and you will find references to them in the Old Testament—we have had to have observers. To cover this particular area, we have coined a new term, "surveillance." Surveillance is simply seeing by means of some sort of sensory device. It may be radar; it may be infrared. It might be photography. It might even be just a pair of binoculars. But in the area of ground combat, where we have had a great deal of discussion about fluidity, mobility, rapid concentration, rapid dispersion, wide gaps, and deep battle zones, we have to have some kind of a device to know where the enemy is. I think it should be self evident that bulky pieces of equipment, somewhat fragile in nature, are not going to live in the forward part of the battle area. You have made a start in the area of radar with TPS/21 and TPS/25, with the airborne side-looking radar with drone systems to carry them, but we haven't begun to solve this problem. I am not a technician. I don't know what is required in terms of technical equipment. I do know what I want as a commander. I want a picture of the enemy displayed in front of my eyes so that I can either engage him by fire or maneuver my troops to meet him. The efforts that have been made with television to date are not satisfactory. We have too much difficulty in reading and it takes too much time to translate radar data into an understandable form. Our platforms for surveillance instruments are not sufficiently reliable or dependable, nor can we be sure that an aerial platform can live in the air. This association is thoroughly familiar with the fact that life goes on 24 hours a day. So does the battle for the ground soldier. He does not have a specific load, that when expended his task is done. He hasn't signed a contract to spend 8 hours behind his rifle and 16 hours in his own pursuits. He hasn't got a snug bunk to retire to when he is overcome with weariness. The nearest tree or the nearest hole may be his haven. If this man is to live, somebody now has to provide him with knowledge derived from the ability to see under all conditions of visibility, weather, terrain, and climate. This then is your second task. Help the Army see.

And third, is the age-old problem of span of control. This is a rather roundabout way of coming to the point of automatic data processing. A commander is limited in his ability to command, first, by the extent of information available to him, second, by his uncertainty as to the reliability of this information, third, by the timeliness of the availability of the information, and fourth, by his ability to assimilate and remember the information. Here it seems to me we have a field day for the electronic brain to extend the memory and the analytical powers for the commander. I don't believe that I could agree to, nor would I seek at this time, a machine with an ability to decide. There are too many intangibles to commit to a system of binary numbers. However, there is certain empirical data relating to the enemy that lends itself to machine storage. There are a multitude of areas in the field of supply to lend themselves to handling by machine. There are a great many areas in the field of personnel. We are going to have to do something to account for radioactive dosage in our troops. How do we keep track of how much a man has had, how much more can he stand, what should we do with him as he approaches his maximum capacity of cumulative dosage?

I am one person who believes in the value of automatic data processing systems (ADPS). I have seen them used to advantage. I was deep in the heart of an experiment in Seventh Army with its modern Army supply system, or mass, one part of which centered on the use of ADPS. As a matter of fact, this experiment has been sufficiently successful up to this point so that a mobile digital computer, Mobidic (Moby Dick), is now in use in Seventh Army. And I can tell you from firsthand experience that it is a wonderful system for the commander. It tells him things that he could not properly develop with the resources normally available to him.

In this area you perhaps have the greatest single objective to overcome. Sold as I am on ADPS, there still gnaws at the back of my mind a serious question as to its durability and reliability under conditions of combat. What do we do if our data is destroyed? We still must eat. We still must move. We still must shoot. This is a problem that must be solved jointly by industry and the military. The Army—and I know that you will recognize that I am expressing what has been termed a parochial view—is sometimes charged with being overly concerned with the acceptance of modern systems, sophisticated devices, and tenuous theories. I would accept this criticism. Yet the Army was a pioneer in ADP in 1946. At the same time I would like you to remember that there is no recall for the ground soldier. There is no respite for him. He cannot wing away to fight again another day. He has to stay and slug it out, and the equipment that he has must be capable of staying with him.

In conclusion then, I would make these points. To win wars, your Army will be your final instrument, because to impose control, you've got to close with the enemy. To do its job, the Army needs this help from you. We need better, more rugged, more reliable communications systems. We need the ability to see under any conditions of weather, terrain, climate, and visibility. We need an ability to present a great variety of information instantaneously upon the call of the commander, information in which he will have confidence and that will assist him in making his decisions. We can fight now. We can fight better with your help.

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Give or take a few hours, 265,000 hours amounts to about 30 years. That's the length of time Westrex, one of the pioneers in high frequency single-sideband systems, has been concentrating on the development and manufacture of communications equipment. The new Westrex Type 9B HF SSB Transmitter-Receiver is the latest result of our single-minded effort to design a low-cost, medium-range unit that can be relied upon for sound, uniform operation. We think the Type 9B is perfect for a variety of fixed or transportable applications. A few are: Civil defense. Government and commercial forestry services. Off-shore petroleum operations. Geophysical research activities. The four-channel Type 9B covers the 2-to-15 mc range and offers a choice of SSB (upper or lower), AM, and CW. A compact 19" wide, 8¾" high, and 15" deep, the set is equipped with a built-in tuneup meter, noise-cancelling handset, and voice-operated VOX circuit. Three 6146 power output amplifiers insure linearity and reliability. Readily operated by non-technical personnel. Other features of the Type 9B are: Power output 100 watts PEP, 100 watts CW, 25 watts AM. Frequency stability ±5 parts in 10^6 with standard oven, ±1 part in 10^6 with high stability oven. Third order non-linear distortion better than 36 db. Receiver sensitivity better than 0.4 microvolt. AGC characteristic less than 3 db variation in output for over 80 db variation in AM and SSB input. Operates on 110 volts, 50/60 cycles, other voltages optional.

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SIGNAL STAFF REPORT

THE PATHFINDER—A SYSTEM FOR

CHOOSING OPERATING frequencies is crucial to good h-f communications, yet much frequency selection is still guesswork. That this is so is due to lack of sufficient information available at the moment of selection. Until recently, schemes and equipments for continual checking of all factors involved in frequency selection were lacking. Only monthly predictions of propagation conditions have been available, thus operators have been forced to rely on intuition and experience rather than on actual data in selecting the correct operating frequency at any given time.

Now a system of equipments, known as PATHFINDER, developed by Granger Associates, Palo Alto, California, measures communications conditions on a real-time basis (that is, almost instantaneously) and presents a current and accurate display of all the factors entering into choice of an optimum communications frequency. An up-to-the-minute display can be had as frequently as is needed. This elimination of the guesswork aspect of frequency selection can slice circuit outage times. Furthermore, it makes communications possible during periods of ionospheric disturbances when frequency predictions are useless and even the most experienced operator is helpless.

In application, this system measures and reports communications conditions between points thousands of miles apart. It provides the information which is essential to the control of reliable long-distance radio communications around the earth.

Presently Used Frequency Selection Procedures

Published monthly, frequency predictions have been the only real assistance operators have had in measing and weighing all the unknowns in frequency selection. Various groups publish predictions of MUF (Maximum Usable Frequency). These are derived from knowledge of long-term dependence of electron density in the ionosphere upon solar activity, and knowledge of the path geometry of the circuits involved. The results are certainly helpful. But they are accurate only on an *average* basis. The meaning to the communications operator of this qualification on the accuracy of published propagation predictions is illustrated graphically in Figure 1. This Figure, taken from a Stanford University research report,* shows the 30-Mc skip distance to the south from Palo Alto, California, as a function of time-of-day for December, 1957. Each dot represents the *measured* hourly mean for a particular day of the month, while the dashed curve is the *predicted* value. It is clear that for some hours of the day the predicted value is an accurate average of the true value, but it is equally apparent that the true value at any particular hour on any particular day can be, and frequently is, very different from the value given by the predictions.

From a propagation standpoint, exact knowledge of the MUF is important because operation just below it is usually the most advantageous. Because of the focussing effect at the skip distance the signal strength is almost always strongest near the MUF. Also, multipath effects which "smear" and garble signals and limit data transmission rate are least bothersome near the MUF, and interference and jamming problems are reduced.

*LaTourrette, "Reduction and Processing of F-Layer Propagation Data," Scientific Report No. 4, Contract AF 19(604)-1830, Stanford University, December, 1960.

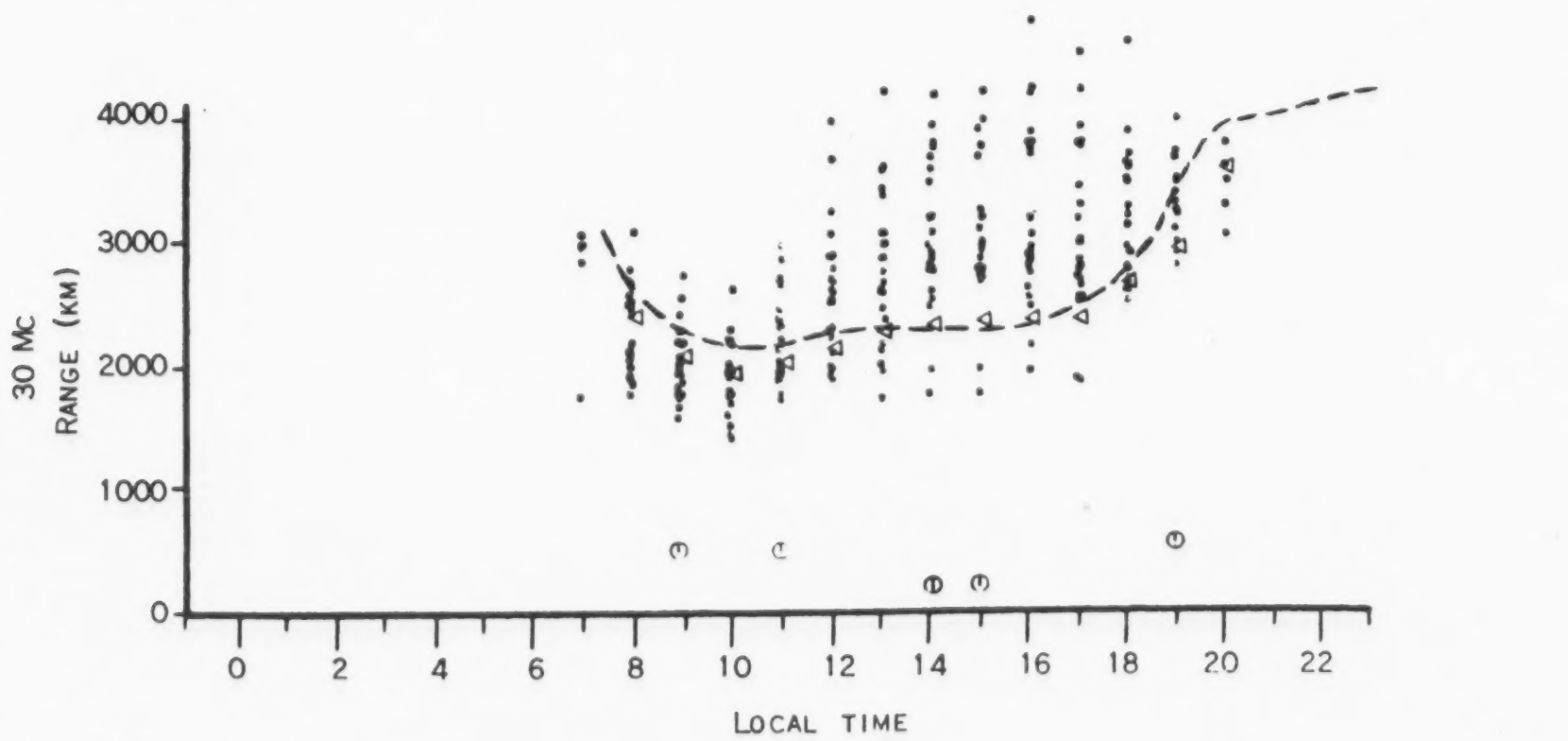


Fig. 1—Equivalent path length vs time: prediction curves and experimental points.

CHOOSING OPTIMUM WORKING FREQUENCIES

Once the MUF can be accurately determined, antenna performance variations as the frequency is changed have to be accounted for. Many commonly used h-f antennas thought to be broad-band are only broad-band from an impedance viewpoint; their patterns are often totally inappropriate for the path involved over most of the intended frequency range. These variations in performance have to be taken into account.

Last, and frequently very important, is the problem of noise and interference at the receiver. This factor cannot be predicted, but must be evaluated each time frequency is changed.

Thus of the three factors to be weighed in choosing an optimum communications frequency—propagation conditions, interference levels, and antenna performance—we are presently providing the communicator only a rough prediction about propagation.

In spite of this handicap, h-f communications now provide the only generally useful vehicle for global transmission of information. The improvements in communications capacity and reliability available through use of the PATHFINDER technique are therefore of considerable significance militarily and economically.

In an effort to improve h-f communications there has been a tendency to seek partial solutions to part of the problem. The situation which has evolved is an unhappy one. The large amount of order-wire traffic, the redundant transmission, the "repeats" necessary to minimize message errors, and the increasing tendency to employ high transmitter power in an attempt to reduce the number of frequency changes required, all contribute to the spectrum congestion which is one aspect of the very problem these measures attempt to relieve. The real problem of determining the best frequency and the data rate it will support cannot be avoided by resorting to brute force methods. What is required is a direct measurement of communications conditions as often as they are likely to change significantly. This is the purpose of the Granger Associates PATHFINDER System.

The changes in propagation conditions can be startlingly rapid at times. During sunset and sunrise the MUF changes quickly—but in a regular way. During periods of ionosphere disturbances, however, conditions alter with extreme rapidity, and there are narrow bands of frequencies which will support communications moving about the spectrum in a quite unexpected fashion. The PATHFINDER is able to locate them, continuously and virtually instantaneously, providing a complete frequency scan as often as every three seconds.

Description of the System

The PATHFINDER display presents the information in such form that it is immediately meaningful to the operator in terms directly applicable to the problem. This is the key to the entire system concept. It deliberately avoids over-complication by not attempting to make automatically decisions which the operator can make more reliably himself on the basis of his experience. In a typical display frequency increases toward the right, and transmission time toward the top of the scope. The signals appearing furtherest to the right are those corresponding to the lowest order mode (smallest number of ionosphere hops) present on the path. The highest frequency present in the signals propagated by

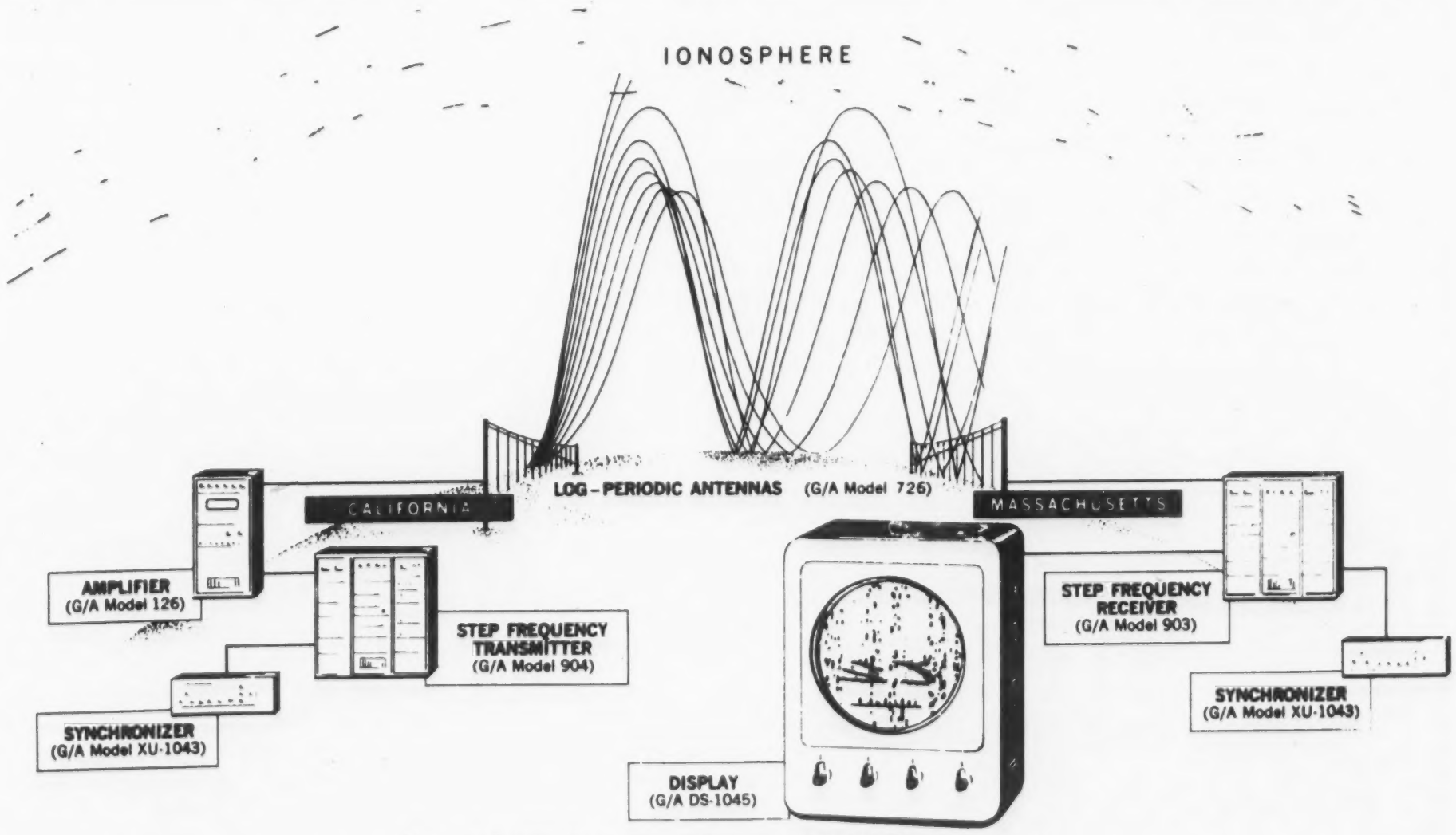


Fig. 2.—Schematic representation of PATHFINDER system as it might operate between California and Massachusetts.

a particular mode is the MUF for that mode. Generally, the signals for the lowest order mode, since they pass through the absorbing layers the fewest number of times, are strongest. The differential path delay, or how long the various ionosphere rays present at a certain frequency take to reach the receiver, is indicated by the spread of the pulse signals in the vertical direction. This is a direct measure of multipath conditions, and the proper criterion to use in determining data transmission rates. At some frequencies several distinct signals are received from the single 200 microsecond pulse emission at the transmitter site. At a given frequency, the time between transmission of successive bits of intelligence has to be greater than this total vertical spread, or the message will be garbled. In other words, the greater the amount of "delay spreading" the lower the undistorted capacity of the communications channel.

Blank spots in the pattern of received frequencies could be caused by an unusual set of propagation conditions, but more likely are the result of nulls in the pattern of the particular communications antenna employed during this particular test. At any rate, the display shows that these particular frequencies are unusable. No ionosphere prediction technique can account for this.

Markers at the bottom of the scope indicate assigned communications frequency channels for the circuit, and the large market extending down from the trace indicates the particular channel in use for communications at that instant. Each assigned communications channel can be aurally monitored for noise and interference by depressing the appropriate channel switch on the front of the display.

The G/A PATHFINDER System is essentially an h-f pulse transmitter and receiver which are tuned in synchronism and are located at the opposite terminals of the path of interest. The transmitter operates in sequence on 160 discrete channels in the h-f band. The receiving system measures the signal amplitude and pulse delay as a function of frequency, and has provision for monitoring on-channel interference. These are the pieces of information which we have seen to be necessary in determining the best operating frequency: the parameters of propagation conditions, interference levels, and antenna performance.

A general understanding of the design concepts employed is helpful

in following the sequence of operation of the system. In the transmitter and receiver, related carrier and local oscillator frequencies are synthesized from very stable frequency standards. The channel selection program, the PRF and all timing references for the display are also derived from this standard. In the receiving system, the local oscillator frequencies injection tune four octave-band superheterodyne receivers, fed from a common receiving multicoupler. This frequency generation and channel selection technique has several important advantages. The task of starting and maintaining the equipments in synchronism, even during a complicated channel selection program, is easily accomplished. Tuning and frequency selection is all electronic, and hence rapid and flexible. The standard equipments sample 160 discrete channels in 3.2 seconds. Much more rapid sampling rates can be provided. With the addition of special accessories, pseudo-random programs are available which are virtually immune to interception and jamming.

Power Amplifiers

The power amplifiers are special. These equipments, providing either 30 or 100 kw of peak power, are broad-band distributed amplifiers. No tuning is required, thereby instantaneous frequency changes are possible.

The antennas usually used with the PATHFINDER are members of the log-periodic family of broadband h-f antennas. These antennas are not subject to the usual antenna limitations of radiation pattern deterioration or impedance change over their operating range, as are conventional rhombics, Yagis, and so forth. The information provided by the PATHFINDER is most useful if the communications antennas have performance similar to the PATHFINDER's antennas. This fact does not impose a penalty since log-periodic antennas of the type used are the best available communications antennas, offering many advantages, as indicated.

Conclusions

The PATHFINDER equipment makes available important improvements in h-f communications. It is the foundation for an adaptive communication system which will continuously and automatically adapt its carrier frequency and data transmission rate so as to maximize communication capacity and reliability.

allowability of advertising costs under defense contracts — end of an era?

by PAUL M. TRUEGER

Mr. Trueger is a C.P.A. and an acknowledged authority in the field of government contract administration and accounting.

THE MAJOR PORTION of advertising costs, previously allowable under defense contracts, has been declared nonreimbursable in the Department of Defense Appropriations Act for 1962. Section 636 of this Act states in part as follows:

> "No part of the funds appropriated herein shall be available for paying the costs of advertising by any defense contractor, except advertising for which payment is made from profits, and such advertising shall not be considered a part of any defense contract cost. The prohibition contained in this section shall not apply with respect to advertising conducted by any such contractor, in compliance with regulations which shall be promulgated by the Secretary of Defense, solely for (1) the recruitment by that contractor of personnel required for the performance by the contractor of obligations arising under a defense contract, (2) the procurement of scarce items required by the contractor for the performance of a defense contract, or (3) the disposal of scrap or surplus materials acquired by the contractor in the performance of a defense contract."

Under the passage of the Appropriations Act, the Department of Defense began a study designed to revise Section XV of the Armed Services Procurement Regulation to reflect the will of the Congress. At the same time, the Military Department procurement agencies were directed to comply with the provisions of the Act, and accordingly, "limit allowability of advertising costs . . . in procurements which will obligate funds appropriated by the 1962 Act, and to the extent practicable, in other new procurements, even though prior years' funds are used."

The allowability of advertising costs under defense contracts is one of the oldest and most controversial problems in defense contract pricing. Probably the best rationale on this subject was contained in the old "Green Book" which attempted a philosophical resolution of this matter and established a compromise, the fundamentals of which lived on for almost 20 years without substantial change. It was reasoned that advertising was not really necessary to do business with the Government and therefore, as a general rule, advertising should be considered as an inadmissible item of cost. On the other hand, it was recognized that "certain kinds of advertising of an industrial or institutional character, placed in trade or technical journals, not primarily with the object of selling particular products but essentially for the purpose of offering financial support to such trade or technical journals, because they are of value for the dissemination of trade and technical information for the industry are not really an advertising expense to effect sales so much as an operating expense incurred as a matter of policy for the benefit of the business and the industry."

The next official, defense-wide publication of consequence in this area was Section XV of ASPR, issued in March 1949. With respect to supply and research contracts with commercial organizations, the following types of advertising were included as examples of items of allowable costs.

> "Advertising in trade and technical journals, providing such advertising does not offer specific products for sale but is placed for the purpose of offering financial support to journals which are valuable for the dissemination of technical information within the contractor's industry."
>
> "Recruiting (including 'help wanted' advertisements) and training of personnel."

Advertising, except for the type described above, was declared unallowable. In this connection, it will be recalled that the 1949 cost principles were specifically and solely applicable to cost-reimbursement type contracts. It is true that many Defense Department auditors, both because they used Section XV as a guide for fixed-price contracts and because they were not able to appreciate the relationship of advertising to defense operations, recommended that considerable portions of advertising should be disallowed under fixed-price contracts. However, many Defense Department contracting officers did not follow these recommendations. Furthermore, the Armed Services Board of Contract Appeals generally looked with favor on advertising as a cost under fixed price contracts, where it was placed in trade and technical journals, and where the purpose was not to promote the sale of the contractor's commercial products.

Over the years, the allowability of advertising costs continued to be handled with significant inconsistency. Even with respect to cost-reimbursement type contracts, where the application of the ASPR cost principles was clearly accepted, substantial controversies were encountered. Chiefly, the two major problems have been (1) the nature of the advertising medium, and (2) the nature of the advertising copy. Each of these problems has its own numerous and complex ramifications. The first problem involved the absence of a clear cut definition of a trade and technical journal. From time to time, when hopes for obtaining a satisfactory definition grew dim, someone would propose that there be issued and maintained a list of publications which would be accepted by Government contracting and auditing authorities as trade and technical journals. These proposals have not been adopted because of the stupendous job involved in establishing such a list and maintaining it on a current basis, especially during these days where such publications flourish in large numbers. This idea has also been rejected because of the problems that would arise where those owners of publications not qualified as trade and technical would submit vehement protests, including political pressures and even possible legal actions. The difficulties involved in this area are illustrated in comments rendered by a high administration official to a member of Congress to the effect that the Air Force Association magazine was not a trade or technical journal within the context of ASPR. Shortly afterwards, this official wrote another letter to the Congressman and stated that his classification of the Air Force magazine was inaccurate. He noted "that there has been no categorical classification of any of a score of magazines which may, under certain circumstances, be considered a trade or technical journal. Rather, the question of whether or not a journal may be considered a trade or technical journal is susceptible to various interpretations. Nor is there a commonly accepted precise definition of what constitutes a trade and technical journal."

There are also substantial difficulties inherent in the interpretation as to when advertising copy offers or does not offer specific products for sale within the meaning of ASPR. In this regard, one of the controversial points involved advertising of a product sold exclusively to the Government or a defense contractor. For example, is a cost of an ad in a trade and technical journal, which depicts a missile, allowable? Under the philosophy expressed in the Green Book which cited "commercial advertising" as unallowable, the cost of the missile ad would be allowable. With regard to subcontractors, the Green Book noted that the considerations relating to the admissibility or limitation upon ordinary or usual commercial selling or advertising expenses may have different aspects in the case of subcontractors than in the case of prime contractors dealing directly with the Government.

The current cost principles, published in November 1959, are generally characterized by fuller and more comprehensive commentaries with respect to contract costs, and instances under which they should be considered allowable and when they should be viewed as unallowable. In addition to this more expanded treatment, the 1959 cost principles appear to be somewhat more liberal than their predecessors. For one thing, with regard to trade and technical journals, the requirement that advertising be placed "for the purpose of offering financial support to such journals" was omitted. Additionally, advertising costs of participation in exhibits and those for obtaining scarce materials or disposing of scrap materials were for the first time specifically cited as allowable. Actually, it was generally concluded, that with respect to advertising costs, the difference between the '59 and '49 cost principles was more a matter of form than of substance. Probably the most consequential point was one which related to the total concept of contract costs rather than advertising expense individually. This was the additional encouragement for the application of ASPR, Sec. XV cost principles to negotiated fixed-price contracts.

Problems and controversies in determining allowability of advertising costs continued to grow. One of the causative factors for this growth was the increase in the number of publications which contain matters relating, in various measures, to defense. Also, proficiency in the artistic aspects of advertising copy became highly developed. As a result, larger and fancier advertisements were placed in an increasing number of magazines. As another point, unofficial (but official sounding) publications more and more competed for advertisements by defense contractors. Congressional and other sources began to feel irritated at the sight of the multitude of lavish art work which, when contained in trade and technical journals, was usually allowed under defense contracts. The irritation probably reached its peak about two years ago when Congress was discussing the relative merits of the Nike and the Bomarc missiles. The companies which fathered each of the missiles, allegedly with the support of the military services involved, expended substantial sums of money on what some Congressmen considered was an attempt to exercise undue influence.

DOD Special Subcommittee

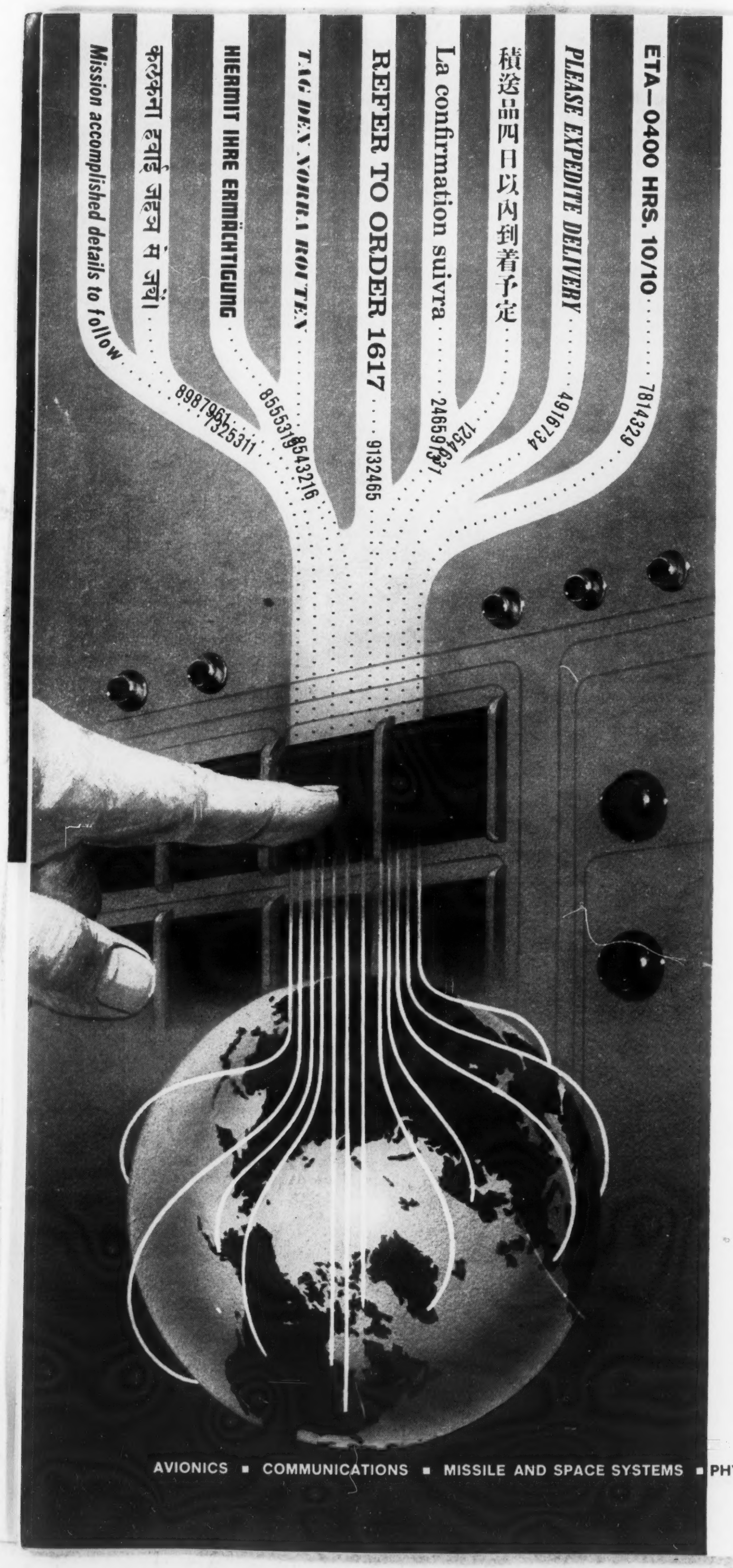
Provisions regarding advertising costs found disfavor with other sources as well. Since the cost principles did not furnish specific criteria for advertising publications and advertising copy, Defense Department contracting and auditing personnel throughout the country were largely left to their own devices. This of course resulted in substantial inconsistencies and › injustices. The Department of Defense established a special subcommittee to promulgate ground rules and interpretations which would permit a consistent DOD position on advertising costs. The special subcommittee deliberated long and hard, and as rather obvious proof that the cost principles were not clear, could not agree as to interpretive guidelines.

The failures on the part of both industry and the Defense Department to develop clear and consistent ground rules for determining allowability of advertising, together with excesses in these expenditures, inevitably led to the killing of the goose that laid the golden eggs. In the absence of moderate proposals, the House of Representatives, in its deliberations on the 1962 defense budget, went to the extreme of passing a bill with the provision which would in effect consider all advertising costs as unallowable under defense contracts. Before the 1962 Defense Appropriations Act became law, many Congressmen and Senators spoke their pieces as did representatives of advertising and industry. The views of the Department of Defense were also requested by Congress. In this latter connection, it is interesting to note that many Defense Department officials at lower levels debated (and made decisions) regarding those publications which should be considered trade and technical journals and in which advertising should be considered allowable, and the extent to which product advertising was to be considered allowable if the product was sold exclusively to the Defense Department. While all this was going on routinely and on a day to day basis, the Secretary of Defense and his top assistants officially advised the Congress that, in their opinion, no advertising should be allowed except (1) recruitment of personnel, (2) procurement of scarce items, or (3) disposal of scrap or surplus (all specifically related to defense contracts). The final language of the defense bill substantially incorporated these views.

What now? In the first place, and this is par for the course, hoards of Government officials are hard at work developing regulations to implement the provisions of the law. This exercise always involves substantial problems and provides considerable work for the legal fraternity in the Government. We might mention just a few of the problems that have already been identified (and many undoubtedly will be in the future) at this time. Referring back to the specific language of Section 636, as quoted in the beginning of this article, the law states that "No part of the funds appropriated herein shall be available for paying the costs of advertising by any defense contractor, *except advertising for which payment is made from profits. . . .*" (Italics supplied.) Does the italicized portion suggest that the amount or percentage of profit negotiated under a defense contract may be increased to compensate the contractor for the amount of advertising disal-

Frequently, various interpretations arise with the passage of a new Congressional law. The new law affecting chargeable advertising as contained in Section 636 of the Department of Defense Appropriations Act for 1962 is a case in point. This is why SIGNAL believes its readers should be given the benefit of Mr. Trueger's views on this subject which is now under deliberation for proper interpretation by a Department of Defense study group.

THE EDITOR



IN DATA PROCESSING...

ITT MOVES FASTER THAN THE TIMES

NEW ITT DIGITAL SYSTEM IS READY FOR THE WORLDWIDE COMMUNICATION NETWORKS OF THE 1970's. When it comes to meeting the complex needs of modern communications systems, the new ITT-025 is a long stride ahead of its field. This sophisticated data processor and message switching center is designed to meet the automation requirements of the communications and data processing systems of the future.

The ITT-025, already in use as the heart of the Strategic Air Command's global communications system, stands ready to make major contributions in areas where efficiency and speed are critical. Air traffic control, automatic check-out systems, complex simulator systems and automatic message processing and switching are examples of its wide range of application.

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lowed as contract cost? We have been advised that this was not the intent of Congress. On the other hand, we are unable to obtain a clear answer as to the specific intent which underlies this phrase, nor are we convinced that this provision may not be subject to controversy.

Another early question relates to the first few words of Section 636: "No part of the funds appropriated herein. . . ." This is construed to mean that advertising costs would be held unallowable with respect to those defense contracts which involve the use of funds appropriated under the 1962 Act. What about contracts which involve funds appropriated by Acts passed in 1961 and prior years? As mentioned earlier, the DOD interim instruction to its procurement offices directs that the new advertising cost prohibitions be used ". . . to the extent practicable, in other new procurements, even though prior years' funds are used." We are not certain as to the connotation of the words "and to the extent practicable." It is apparent that the application of this limitation to contracts obligating funds of prior years is not required by the law. The DOD instructions contain no guidance relative to going contracts. Since some of the current contracts will run for several years, can we expect the use of separate overhead rates: inclusive of advertising for old contracts and exclusive of advertising for new contracts?

Let us consider another question of the many potential ones, and this would relate to the language appearing in connection with the three specific circumstances under which advertising is to be allowable. In each case there is a specific reference to "a defense contract." A strict interpretation of the statute would suggest that, for example, the cost of help wanted advertising would be allowable only when it could be identified as recruiting personnel for a specific contract, and this would establish recruitment expense as a direct charge. The same problem is involved with regard to advertising for procurement of scarce items and disposal of surplus materials. Consensus of opinion among DOD officials is that this interpretation would neither be practical nor feasible.

We could probably raise a dozen other points of this kind but shall limit this discussion to just one other. Advertising for recruitment of personnel is allowable under the law. How about a full page ad in a magazine which deals with a firm's products or capabilities but which contains a one line statement that electronic engineers are needed and that applications should be forwarded to a given address? Some DOD officials we questioned expressed the opinion that this would be subterfuge and hence definitely unallowable. Others were not quite as certain. Let us make the question a little more difficult. What if the ad is divided half and half between help wanted and company capability? Doubt increases. Now, what is the status of an ad devoted 75% (or 95%) to personnel recruitment and the smaller balance to the company's products and/or capabilities?

The problems mentioned above and others are under deliberation by a DOD study group. These people have our sympathy. We doubt that it is humanly possible to promulgate interpretations which will be clear or satisfactory to all.

Product Advertising Benefits

The problems inherent in the interpretation of the new law, of course, constitute a minor portion of the objections to its provisions. Of considerably more significance is the principle involved in singling out a particular category of cost and arbitrarily declaring that the portion thereof allocable to Government contracts, on a pro rata basis, will not be reimbursed by the Government. Even before the enactment of the restrictive provisions contained in this law, the opinion was held by many that the provisions of ASPR XV were incorrect in principle. A substantial school of thought held that the only justifiable basis for questioning advertising expenses would be when the amount involved was unreasonable. Otherwise, even where the primary objective was to promote sales of commercial products, advertising could be considered a normal expense of doing business. In this connection, we would refer the reader to Chapter XIII of our text (*Accounting Guide for Defense Contracts*, 3rd Edition, 1960, Commerce Clearing House, Inc.). We established the point that such expenses as product advertising, by increasing the company's sales volume, increase the cost of sales or whatever basis is used to compute percentages for allocating the administrative and selling expenses. In this manner, the Government actually derives a definite benefit from commercial product advertising through a lower expense rate.

However, as we mentioned earlier, the concept of some type of restriction on advertising expenses has been generally accepted for the past 20 years. This point was made clear in the various statements made before the United States Senate during the 1962 Appropriations Act hearings in the sense that no objections were raised to the general principle of restrictions on advertising costs. As a matter of fact, most of the speakers appeared to concede that restrictions such as exclusion of product advertising were appropriate. There were, however, many objections raised to the prohibition against advertising costs other than help wanted, procurement of scarce items and disposal of scrap or surplus materials. Probably the major and most frequently mentioned objection involved the substantial usefulness of trade and technical journals in enhancing the state of the art and the various scientific and industrial fields in which interests are shared by the Government. The point was repeatedly made that these magazines, useful for all engaged in a particular line of endeavor, from the student to the highest ranking Government or industrial technician, could not live without the income derived from advertisements. And, where trade and technical journals would cease publication, what medium could substitute in the job of disseminating the valuable trade and technical information?

In a somewhat different line, the argument was advanced that those firms which are engaged solely or substantially in defense work should be given an opportunity to maintain at least their names before the public. Modern technology being what it is, it is not unusual for the Defense Department to abandon a specific category of offensive or defensive weapons, leading to the termination of contracts held by prime and subcontractors involved in this program. Where it becomes necessary for a company to switch quickly into commercial business, or even if it must convert its capabilities into a somewhat different area within the defense activities, a failure to keep its name before potential customers (Government and non-Government) could be extremely costly.

Technical Journals Useful to DOD

Among the many other arguments advanced against this provision was the one concerning the particular usefulness of the trade and technical publications to the Defense Department. It is a matter of common knowledge that many of these journals are to be found in numerous offices of Government procurement, engineering and manufacturing officials. Many of these officials are quick to concede that they find these magazines very useful in the performance of their duties.

The impact of this restriction is not easy to forecast. Certainly, the continued publication of worthwhile trade and technical journals is essential to the technological progress of this country and its security. Many companies will continue to place ads in these journals to provide the financial support necessary for the publications to continue at a price which will make them reasonably available to the many engineers, scientists, and others who need to read them. On the other hand, unless some relaxation of these restrictions is provided in the future, it would be expected that some of the companies will be reviewing their advertising programs with a view towards reducing the amount of expenditures now to come out of profits. Where a worthwhile journal ceases publication, or raises its subscription to the point of placing it out of reach of the many people who should be reading it, the best interests of this country will not be served.

M. I. T.'S FX-1 DIGITAL COMPUTER

SIGNAL STAFF REPORT

THE FASTEST DIGITAL COMPUTER ever built is now in operation at the Massachusetts Institute of Technology's Lincoln Laboratory in Lexington. Massachusetts. Known as the "FX-1," this new computer is in every important respect a working model for a new generation of machines, ten times faster than any computers in general use today. The significance of the new machine lies not in its size or capacity, which are modest, but in the unusually high speed at which it operates, and in new construction techniques designed especially for high frequency operation.

It is the first machine with a main memory using thin magnetic films in place of ferrite cores for high-speed, random-access storage. FX-1 is designed to be a complete, small-scale, general-purpose computer, for realistic tests of fast logic circuitry and magnetic film storage in system operation.

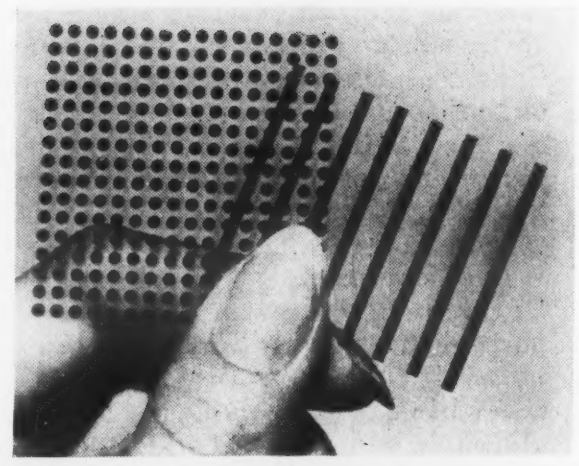
In specifying the speed of a computer, there are two items of particular interest: (1) the time required to read a computer word out of the *memory* and to write in a new word (the "read-write cycle time"), and (2) the speed of the *logic circuits*, which may be specified by the rate of the timing pulses which govern the operation of these circuits (the "clock rate"). Both of these items are noteworthy in the FX-1, since in both instances the new machine is substantially faster than the most advanced commercial computers of today.

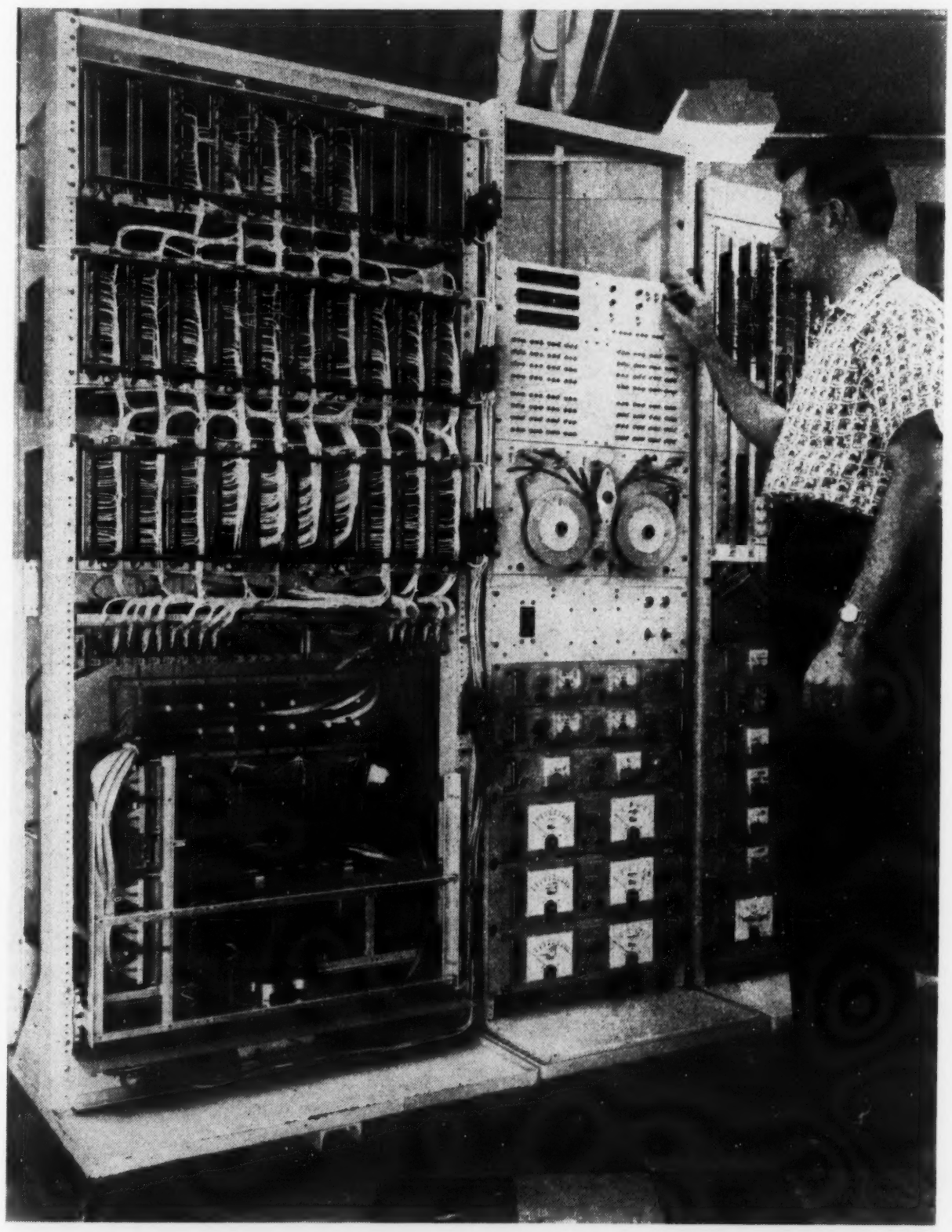
Memory

The read-write cycle time for the central memory of the Lincoln FX-1 is 0.3 microsecond. The fastest main memories in machines today have cycle times that generally range from 2 to 12 microseconds. These memories use magnetic cores for storage following techniques developed by Lincoln Laboratory some years ago, without which the large, high-speed, general-purpose computers of today could not have been developed. The largest core memory in existence, with a capacity of more than 2,500,000 bits, was built by Lincoln some four years ago and is part of the older Lincoln TX-2 computer. This large core memory has a read-write cycle time of 6.5 microseconds.

Also a part of TX-2 is a small fast memory using thin magnetic films, the first such memory to be installed in a computer. In regular use for almost two years, this magnetic film memory operates in TX-2 with a cycle time of 0.8 microsecond, consistent with its functions in the computer itself; in bench tests, a cycle time of 0.4 microsecond was at-

In **Figure 1 (Right)** arrays of magnetic film memory elements deposited on thin glass plates are shown. The round elements are used in the early TX-2 memory, the rectangular ones in the new FX-1 computer. **Figure 2 (Below)** shows M.I.T.'s FX-1 computer.





tained, limited by the performance of the transistors that were available at the time the memory was built.

The faster magnetic film main memory in the new FX-1 profits from improved transistors, circuitry and fabrication techniques that have been developed in the intervening two-year period. Figure 1 shows two arrays of magnetic film memory elements deposited on thin glass plates. The circular spots were used in the small TX-2 memory; the small rectangular spots are used in FX-1.

The initial FX-1 memory has a capacity of 256 words of thirteen bits each, but provision has been made to increase the initial capacity by a factor of four. This memory is large enough to serve the purpose of FX-1, to provide a realistic test of fabrication and operating techniques on a practical scale, and at the same time to provide sufficient storage to enable the machine itself to be useful for some practical purposes. Because of the high speed of the logic circuits and the short cycle time of the memory, the FX-1 can match the performance of considerably larger conventional machines.

The memory employs printed-circuit wiring on a flexible sheet of resin-impregnated, glass-fiber cloth. Two halves of flexible wiring sheet are mounted on stiff backing boards, leaving a flexible hinge between the halves. The arrays of memory elements, deposited on thin glass backing plates, are positioned on the wiring so that each magnetic-film element rests on the intersection of two perpendicular leads on the wiring sheet. When all the memory element arrays are in place on the lower half of the wiring sheet, the upper half is folded over to make the completed memory. This single unit contains the 256-word, 3328-bit memory of the FX-1 computer.

Circuits

The logic circuits in Lincoln's new FX-1 operate at an effective clock rate of 50 million pulses per second, ten times faster than TX-2 and other large machines currently in operation, and four times the rate of the fastest commercial machine disclosed to date. This increase in speed is made possible by high-speed switching transistors developed under subcontract, with the collaboration of Lincoln's Computer Components Group, and now in commercial production. The fastest commercial machines now in common use have clock rates comparable to that of the TX-2.

Approximately 3000 transistors are used in the FX-1; this is about the same number as in the Lincoln TX-0 computer, built about five years ago, which was the same forerunner of the TX-2 computer in use at the Laboratory today. TX-2 has some 30,000 transistors in the central machine, and one of the large new commercial machines will have as many as two hundred thousand.

The FX-1 logic circuits are packaged in plug-in units that have been designed for compactness, as well as being particularly suited to high frequency operation. Components are mounted on or between two printed-circuit boards that are an integral part of the mechanical framework of the plug-in unit. The plug-in units are mounted in trays that hold up to twenty units each and themselves plug into the computer frame. Plug-in units with closely related functions are located on a common tray to simplify interconnections.

Approximately 325 plug-in units of 12 standardized basic types are used in the FX-1. They are mounted in 24 trays, of 13 different types. The entire computer, with power supplies, occupies only three relay racks, as shown in Figure 2.

Some of the trays in the FX-1 are fabricated by a developmental technique called "plated-circuit" wiring, as contrasted with "printed-circuit" wiring for the plug-in units and conventional point-to-point soldered wiring for most of the trays. The plated-circuit trays employ two layers of etched wiring sandwiched on either side of a central copper ground plane. Wiring of this type behaves like strip transmission line, with uniform impedance characteristics that should simplify and improve circuit performance at high frequencies. Interconnections from one layer of wiring to another are made by plated-through holes rather than by soldering. The FX-1 is a good vehicle in which to test this type of wiring where it is an important factor in the performance of high-frequency circuits.

The FX-1 computer was designed and built by the Digital Computers Group in the Information Processing Division of the M. I. T. Lincoln Laboratory, with assistance from Lincoln's Computer Components Group. Lincoln Laboratory, a center for research, is operated under Air Force contract by the Massachusetts Institute of Technology, with the joint support of the U. S. Army, Navy, and Air Force.

BIRDIE
AIR DEFENSE SYSTEM

SIGNAL STAFF REPORT

WITH THE ADVENT OF ANTI-AIRcraft missiles, Nike-Ajax, and, still later, Nike-Hercules, the U. S. Army Air Defense Command found a new system was needed to coordinate batteries of these weapons in order to achieve maximum effectiveness and target construction. As a result, in 1955, the Martin Company was awarded a $95 million contract for the development and production of a fire control system which could (1) generate and present to the integrated fire units a comprehensive picture of the over-all air battle situation, and (2) provide facilities for monitoring and directing the actions of those fire units from some higher command level.

In December of 1957, the Army unveiled the Martin Company's Missile Master system which has been generally recognized as an effective system for coping with complex air situations involving a maze of targets and for coordination of missile firepower that must be brought to bear upon those identified as hostile. These Missile Masters, coordinating large numbers of guided missile batteries, are now in operation protecting ten of the country's largest metropolitan areas.

Installation of Missile Master in other than the largest, high priority, target areas, however, has not been economically feasible. It has been apparent from the first that some way had to be found to extend the same kind of anti-aircraft protection to other vital target areas of lesser size and close important gaps in our air defense while at the same time holding the cost factor to a minimum.

A midget Missile Master, much cheaper than its larger counterpart, which can be operated with a tremendous saving in electric power and personnel, has been accepted for use by the U. S. Army. This system was described at a Press Conference in Washington, D. C., last month. Called BIRDIE (for Battery Integration and Radar Display Equipment) by the Martin Company, prime contractor for the system, it is designed to help protect military installations, or cities in the 600,000 population class. BIRDIE is a transistorized fire detection system occupying 97 percent less space than Missile Master, using 95 percent less power and requiring 80 percent fewer personnel to operate. The average BIRDIE costs approximately half a million dollars.

Two versions of BIRDIE have been developed—the AN/GSG-5 and the AN/GSG-6. The GSG-6 is the smaller version which coordinates and directs a limited number of fire units. It routes externally-generated and/or locally-generated target data to the fire units. An electronic pointing device assists in the designation of targets and in the conduct of the air battle. The larger version, the GSG-5, coordinates and directs many fire units. It stores, processes and continuously updates target information for directing the fire of these units.

Like Missile Master, BIRDIE processes and distributes to guided missile batteries information concerning target aircraft, and coordinates the fire of the Nike-Ajax and Nike-Hercules missiles deployed in the defended area. Since BIRDIE is currently programmed for deployment in the United States, it has been designed to work closely with the Semi Automatic Ground Environment or SAGE system established by the North American Air Defense Command. Though integrated with SAGE in normal situations, the BIRDIE system has the ability to function completely autonomously in the event that data transmission from SAGE is interrupted.

All equipment comprising the BIRDIE 5 and 6 systems is housed within transportable shelters, so that the systems can be readily deployed in any environment. Within the shelters, all operator functions of target surveillance, tracking and weapons monitoring are combined into a single console. All system shelters are identical in their structural characteristics and the dimensions allow for universal highway and rail transport both in the U.S. and in Europe and shipment by many transport aircraft such as the C-124, C-130 and C-133. Shelter weight is about 7000 pounds.

Target data from SAGE is transmitted digitally to BIRDIE. Upon receipt of SAGE data, the digital messages are decoded and processed for recording on a magnetic drum. The position and velocity data are routed to a computer, which continuously updates all track data. The stored information is automatically routed to a display generator, which converts the digital data into track symbols. for display on the console.

The target symbols move automatically as determined by the BIRDIE tracking computer. The stored data is also routed to a Battery Data Link transmitter, for conversion to proper digital format for transmission to the fire units. By means of a Plan Position Indicator scope (PPI) console operators are provided with a current picture of the local air situation. By being familiar with the various synthetic tags that appear on the scope. the operator can decipher this symbology and make tactical decisions based on observations. The fire unit commanders also have a PPI scope display and are thus aware of particular targets that are to be engaged by specific fire units. With this complete picture of the local air situation, the defense commander and his staff have an up-to-date store of information to assist them in making tactical decisions and allocating available forces.

All major electronic components of the system are housed within two equipment bays designed to minimize over-all size while providing adequate access for maintenance and repair. The compactness of the system has been achieved by making the digital components (80 percent of the system) completely transistorized.

The first BIRDIE was installed at Turner Air Force Base, near Albany. Georgia, in July 1961. Seventeen other BIRDIE systems are scheduled for installation at an early date.

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Listed below are the firms who are sustaining and group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

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NEW YORK: Pres.—G. D. Montgomery, AT&T Co., 32 Ave. of the Americas. Sec.—R. D. Watson, AT&T Co., 32 Ave. of the Americas, N. Y. 13, N. Y.

NORTHEASTERN UNIVERSITY: Pres.—R. Zaruba, 66 Washington St., Wellesley, Mass. Sec.—M. Feerick, Jr., 96 Library St., Revere, Mass.

ROME-UTICA: Pres.—R. C. Benoit, Jr., 138 Riverview Pkwy. N., Rome, N. Y. Sec.—R. A. Arnold, P.O. Box 666, Rome, N. Y.

SOUTHERN CONNECTICUT: Pres.—John N. Higgins, Marketing Management Associates, Inc., Ridgefield, Conn.

SYRACUSE: Pres.—Capt. J. E. Thompson, USN, 26th Air Division (SAGE), Hancock Field, Syracuse 25, N. Y. Sec.—John G. Labedz, Western Electric Co., 320 Thompson Rd., E. Syracuse, N. Y.

REGION B1

Regional Vice President—William Christopher, Sylvania Electronic Systems, 1120 Conn. Ave., Wash., D. C. ***Delaware, District of Columbia, Maryland, Eastern Pennsylvania and Virginia.***

BALTIMORE: Pres.—Cdr. Bob Kirsten, USCG, U. S. Coast Guard Yard, Curtis Bay, Baltimore 26, Md. Sec.—Thomas E. Thompson, Jr., The Martin Company.

PHILADELPHIA: Pres.—R. R. Waller, Electronic Data Processing Div., RCA, Camden 2, N. J. Sec.—F. O. Ziegler, Bldg. 2-5, RCA, Camden 2, N. J.

WASHINGTON: Pres.—W. W. Alvis, Western Union Tele. Co., 425 13th St., Penna. Bldg., Rm. 544, Wash. 4, D. C. Sec.—W. Hulse, Westinghouse Electric Corp., 1625 K St., Rm. 204, Wash. 6, D. C.

REGION B2

Regional Vice President—Paul H. Clark, Radio Corporation of America, 224 N. Wilkinson St., Dayton, Ohio. ***Kentucky, Ohio, West Virginia and Western Penn.***

CINCINNATI: Pres.—R. G. Edwards, 1014 Vine St., Cincinnati 2, Ohio. Sec.—G. Geick, Avco Corp., 2630 Glendale-Milford Rd., Cincinnati 2, Ohio.

DAYTON-WRIGHT: Pres.—A. F. Schmahl, 650 Brubaker Dr., Dayton 29, Ohio. Sec.—Miss Marlene P. O'Neal, 828 Highridge Ave., Dayton 20, Ohio.

LEXINGTON: Pres.—Lt. Col. H. L. Morris, USA, 3534 Greentree Rd., Lexington, Ky. Sec.—H. G. Flanary, 218 Bell Ct., W., Lexington, Ky.

PITTSBURGH: Pres.—R. H. Creps, Bell Tel. Co., 201 Stanwix St., Pgh. 22, Pa. Sec.—H. W. Shepard, Jr., 625 Stanwix St., Pgh.

REGION C

Regional Vice President—W. K. Mosley, Southern Bell T&T Co., Hurt Bldg., Atlanta, Ga. ***Southeastern States along Atlantic and Gulf coasts—from North Carolina to Louisiana including Tennessee.***

ATLANTA: Pres.—Capt. I. J. Schwartz, USN, USN Air Station, Atlanta, Merritt, Ga. Sec.—M. S. Butler, P. O. Box 685, Atlanta Airport, Atlanta 20, Ga.

AUGUSTA-FORT GORDON: Pres.—Col. T. J. Trainor, Route 2, Box 1016, Augusta, Ga. Sec.—L/C H. T. Crowell, Hqs. Detachment (Television Branch) U. S. Army Southeastern Signal School, Ft. Gordon, Ga.

CAPE CANAVERAL: Pres.—G. Meredith, 110 Atlantic Blvd., Eau Gallie, Fla. Sec.—Lt. Col. L. A. Breece, 399 Norwood, Eau Gallie, Fla.

CENTRAL FLORIDA: Acting Sec.—R. R. Randell, 208 So. Manhattan Ave., Tampa, Fla.

GULF COAST: Pres.—H. D. Yund, 10 - 30th St., Gulfport, Miss. Sec.—R. C. Cox, Southern Bell, 500 Rich Ave., Gulfport, Miss.

LOUISIANA: Pres.—J. C. Morris, 206 Gibson Hall, Tulane U., 6823 St. Charles Ave., New Orleans 18. Sec.—R. C. Hingle, Southern Bell Tel. & Tel. Co., 1215 Prytania St., New Orleans, Louisiana.

MIDDLE GEORGIA: Pres.—John Booth, Southern Bell Tel. & Tel. Co., 787 Cherry St., Macon, Ga. Sec.-Treas.—J. D. Walker, Southern Bell Tel. & Tel. Co., Warner Robins, Ga.

MONTGOMERY: Pres.—Lt. Col. Herbert Herman, Air Command & Staff College, Maxwell AFB, Ala. Sec.—Luther L. Hall, 3549 Cloverdale Rd., Montgomery, Ala.

NORTH CAROLINA: Pres.—Col. P. Van Sloun, XVIII Airborne Corps, Ft. Bragg, N. C. Sec.—H. N. Simpson, Carolina Tel. & Tel. Co., Tarboro, N. C.

NORTHWEST FLORIDA: Pres.—Col. S. K. Briggs, 708 Osegola Cir., Eglin AFB, Fla. Sec.—Maj. N. E. Zielinski, Hq. APGC, Elgin AFB, Fla. Sec.—W. E. Shine, 505 Gaffney Rd., Eglin AFB, Fla.

ORANGE: Acting Pres.—Vincent Meder, 744 S. Hampton, Orlando, Fla.

PENSACOLA: Pres.—Lt. Cmdr. H. M. Young, 4216 Acacia Dr., Pensacola, Fla. Sec.—D. E. Hansen, 208 Emerald Ave., Pensacola.

REDSTONE-TENNESSEE VALLEY: Pres.—Col. Earl J. Dotson, Sig. Office Hq. USA Ordnance Missile Command, Redstone Arsenal, Ala. Sec.—Lt. Col. Henry B. Holmes, III, AOMC Sig. Office, Redstone Arsenal, Ala.

SOUTH CAROLINA: Pres.—H. L. Lackey, Southern Bell Tel. & Tel. Co., Columbia, S. C. Sec.—K. Hora, Southern Bell T&T Co., Owen Bldg., Columbia, S. C.

REGION D

Regional Vice President—Maj. Gen. Harry Reichelderfer, USA (Ret.), Southwest Research Institute, 8500 Culebra Rd., San Antonio, Tex. ***New Mexico, Texas, Oklahoma, Arkansas.***

LAWTON-FORT SILL: Pres.—Lt. Col. L. W. Ash, 1303 W. Upton Rd., Fort Sill, Okla. Sec.—Lynn Russell, 1805 Dearborn, Lawton, Okla.

NORTH TEXAS: Pres.—R. T. Shiels, Anaconda Wire & Cable Co., 1201 Fidelity Union Life Bldg., Dallas 1. Sec.—Robert J. Novak, AT&T Co., 212 No. St. Paul St., Dallas.

SOUTH TEXAS: Pres.—Col. A. Burke, Hqs., 4th U. S. Army, Ft. Sam Houston, Texas. Sec.—W. Gillum, (same address).

TINKER-OKLAHOMA CITY: Pres.—W. J. Cook, P. O. Box 5766, Midwest City, Okla. Sec.—R. E. Davis.

WHITE SANDS MISSILE RANGE: Pres.—S. D. Cozby, 704 Sugeant St., White Sands, N. M. Sec.—C. E. O'Meara, 1400 S. Luna, Las Cruces, N. M.

REGION E

Regional Vice President—Walter H. Pagenkopf, Teletype Corp., 5555 Touhy Ave., Skokie, Ill. ***Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, North Dakota, South Dakota, Wyoming, Colorado.***

CHICAGO: Pres.—Walter H. Flinn, Illinois Bell Tel. Co., 212 W. Washington St., Rm. 1601, Chicago 6, Ill. Sec.—Sanford Levey, 1303 Lincoln Ave. So., Highland Park, Ill.

DECATUR: Pres.—Capt. J. J. Lacey, 53 Whippoorwill Dr., Decatur, Ill. Sec.—H. E. Malone, 3814 Arthur Ct., Decatur, Ill.

GREATER DETROIT: Pres.—Col. J. I. Vanderhoof, 1921 Brock Court, Ann Arbor, Mich. Sec.—J. R. Saxton, Michigan Bell Telephone Co., 1109 Washington Blvd. Bldg., Detroit.

KANSAS CITY: Pres.—Lt. Col. H. Young, Jr., 29th AD Hq., Richards-Gebaur AFB, Mo. Sec.—W. B. Foulis, Jr., AT&T Co., Rm. 870, 811 Main St., Kansas City, Mo.

ROCKY MOUNTAIN: Pres.—Col. L. C. Heartz, 2301 Clarkson Dr., Colorado Springs, Colo. Sec.—Maj. H. W. Beaver, USAF (Ret.), 1936 Downing Dr., Colorado Springs.

SCOTT-ST. LOUIS: Pres.—Col. C. W. Evans, USA (Ret.), Southwestern Bell Telephone Co., 1010 Pine St., Rm. 827, St. Louis 1, Mo. Sec.—A. L. Eisenmayer, P.O. Box 456, Trenton, Ill.

REGION F

Regional Vice President—Lt. Cdr. Ray E. Meyers, USN (Ret.), Consultant, 717 Anderson Way, San Gabriel, Calif. ***Arizona, Utah, Nevada, California, Idaho, Oregon, Montana and Washington.***

ARIZONA: Pres.—Lt. Col. James W. Tuma, 109 Madden, Fort Huachuca, Ariz. Sec.—Frank T. Trippi, Hqs. USA Electronic Proving Ground, P.O. Box 436, Fort Huachuca, Ariz.

GREATER LOS ANGELES: Pres.—John W. Atwood, Hughes Aircraft Co., Culver City, Calif. Sec.—Joseph H. Goodrich, Pacific Tel. & Tel. Co., 737 S. Flower St., Los Angeles 17, Calif.

SACRAMENTO: Pres.—R. C. Berner, Pacific Tel. & Tel. Co., 4501 Arden Way, Sacramento 25, Calif. Sec.—Miss Ethel Klusman, 4925 Marconi Ave., Carmichael, Calif.

SAN DIEGO: Pres.—Capt. B. L. Bailey, USN, Cmd. Off. Miramar Naval Air Station, Miramar 45, Calif. Sec.—J. C. Orthel, 5483 Redding Rd., San Diego 15, Calif.

SAN FRANCISCO: Pres.—Col. H. L. Davis, Jr., 331 Infantry Terrace, Presidio of San Francisco, Calif. Sec.—H. W. Weddell, Rm. 117, Bldg. 35, Presidio of San Francisco, Calif.

SANTA BARBARA: Pres.—RAdm. Clarence C. Ray, 63 Manzanita Lane, Star Route, Santa Barbara, Cal. Acting Sec.—E. E. Foley, P.O. Box 636, Santa Barbara, Calif.

SEATTLE: Pres.—RAdm. H. H. McCarley, USN, 436 168th St., S.E., Bellevue, Wash. Sec.—W. E. Cruse, 4001 W. Concord St., Seattle, Wash.

EUROPEAN REGION

Regional Vice President—Brig. Gen. Kenneth F. Zitzman, USA (Ret.), International Standard Engineering, Inc., 40 Rue de Sevres, Boulogne Billancourt Seine, France.

FRANKFURT: Acting Pres.—Ralph L. Prokop, USA Procurement Center, APO 757, N. Y.

LONDON: Pres.—Lt. Col. S. B. Hunt, USMC, Cincnelm, Box 91, FPO, N. Y., N. Y. Sec.—Lt. Col. J. C. Posey, HQ. 3d COMM. GP., APO 125, N. Y., N. Y.

PARIS: Pres.—RAdm. T. A. Torgerson, HQ. U.S. EUCOM C E, APO 123, N. Y., N. Y. Sec.—Maj. John E. Mills, 7th Signal Battalion, SHAPE, APO 55, N. Y., N. Y.

SWITZERLAND: Pres.—B. R. Dean, 13 Quai de L'ile, c/o RCA, Geneva, Sec.—Lt. Col. A. David, Royal Signal, British Army, U. N., Geneva.

PACIFIC REGION

Regional Vice President—Brig. Gen. Douglas Williams, USAF, Staff CINCPAC, APO 953, San Francisco, Calif.

HAWAII: Pres.—Col. W. A. Simpson, USA, Signal Office, Hq. USARPAC, APO 958, San Francisco, Calif. Sec.—Lt. Col. G. A. Kurkjian, USA (same address).

KOREAN: Acting Sec.—Col. J. E. Gonseth, Jr., J6 Div., UN Command, APO 301, San Francisco, Calif.

MARIANAS: Pres.—Cmdr. C. J. Alley, USN, U. S. Naval Comm. Sta., Navy 926, FPO, San Francisco, Calif. Sec.—Lt. Cmdr. W. Scott, USN, P. O. Box, FPO, San Francisco, Calif.

OKINAWA: Pres.—Lt. Col. L. P. Wynne, Cmdr. 1962nd AACS Squadron, APO 239, San Francisco. Sec.—E. N. Dotson, USCAR, APO 331, San Francisco.

PHILIPPINE: Pres.—Lt. Col. A. W. Hall, STARCOM, QTRS. 31 Clark, U. S. Acan Station, Philippines, APO 74, San Francisco, Calif. Sec.—J. C. Behrick (same address).

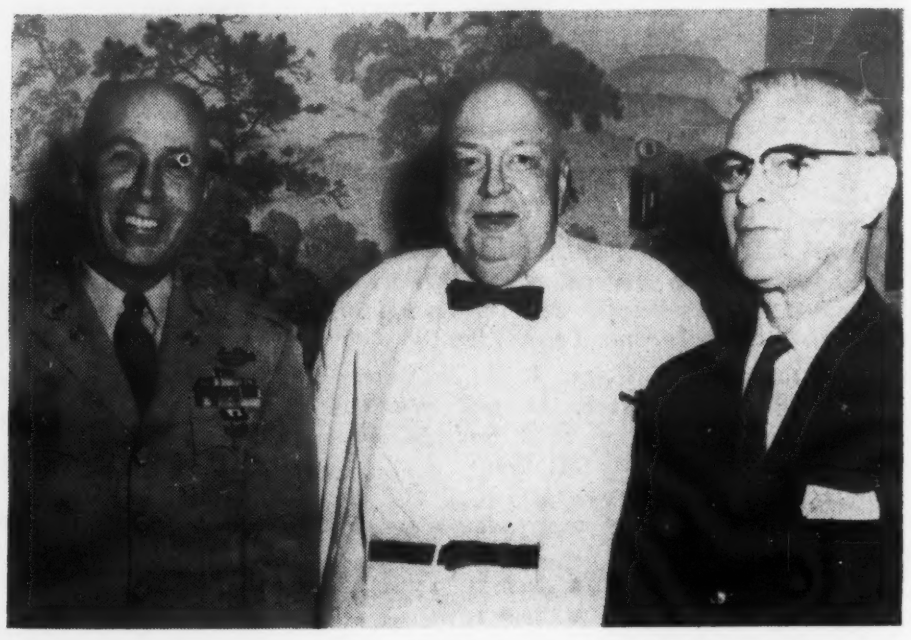
TOKYO: Pres.—Capt. W. H. Kreamer, USN, Staff COMNAVFOR, Japan, FPO, San Francisco, Calif. Sec.—Lt. W. E. Trelford, USN (same address).

CHAPTERS AT LARGE

ALASKA: Pres.—Col. H. L. Hughes, USAF Hq. Alaskan Air Command, APO 942, Seattle, Wash. Sec.—T. C. Harris, 2411 Karluk St., Anchorage, Alaska.

SAN JUAN: Pres.—W. Siddall, Radio Corporation of Puerto Rico, P. O. Box 3746, San Juan 18, P. R. Sec.—A. R. Crumley, Jr., Crumley Radio Corp., Box 10073, Caparra Heights, San Juan.

Chapter News



Augusta-Fort Gordon—Lt. L. Parrish, one of the students in a Signal Officers Orientation course at Fort Gordon's Army Signal Training Center, receives a 100 percent Membership Plaque from Col. T. J. Trainor, chapter president. (left photo)
Louisiana—Shown at a recent meeting at Camp Leroy Johnson are (L to R) Col. J. V. Smith, Deputy Commander, Camp Leroy Johnson; Dr. J. C. Morris, chapter president; and Col. R. O. Williams, 1st vice president. (right photo)

REGION A

Lexington-Concord

At a recent meeting the following were elected chapter officers: president, George Twigg III, Raytheon Company; vice president, Colonel Harry A. Wilson, USAF Electronics Systems Division, L. G. Hanscom Field; vice president membership, Grady Holt, General Dynamics; vice president education, Colonel Robert Lynch, USAF, Electronics Systems Division, L. G. Hanscom Field; vice president programs, Thomas L. Longtine, Raytheon Company; secretary, William Thresher, Radiation Incorporated; and treasurer, Milton Gould, Mitre Corporation.

REGION C

Augusta-Fort Gordon

At the dinner meeting held August 17, at the Fort Gordon Officers Club, Dr. Leland L. Antes, chief scientist for the Martin Company was guest speaker. His subject was "Communications for Defense and Space." Dr. Antes explained the Martin Company's Random Access and Correlation for Extended Performance (RACEP) communication system, and summarized its possible utilization in the field of guided missiles, troposcatter, air-to-ground and tactical communications.

Four classes of officers enrolled in the Signal Officers Orientation course at the Southeastern Signal School, were awarded plaques for attaining 100 per cent membership in AFCEA.

Cape Canaveral

Chuck Bailey of the Missile and Space Vehicle Department of General Electric Company was guest speaker at the August 17 luncheon meeting held in the Atlantic Room of the Patrick Air Force Base Officers Club. Mr. Bailey spoke on Space Communications and Project Advent.

Tentative dates for a Symposium to be held in the Cape Canaveral area are March 6, 7, 8, 1962. The general subject will be "Test Problems of Tomorrow's Rockets." Roy Totty of Pan American Airways, is general chairman for the symposium.

Louisiana

A recent meeting at which the election of officers took place was held at the Commissioned Officers Mess, Camp Leroy Johnson, Lakefront.

Officers elected were the following: president, Dr. J. C. Morris; first vice president, R. O. Williams, USAR; second vice president, J. D. Bloom; third vice president, J. T. Clements; fourth vice president, W. J. DeArmas, Jr.; fifth vice president, J. H. Broyl; secretary, R. C. Hingle; and treasurer, A. B. Hay.

Redstone-Tennessee Valley

At the pre-charter meeting held August 17, officers were elected to serve until the next annual meeting in January, 1962. Those elected were president, Lieutenant Colonel Earl J. Dotson, Army Ordance Missile Command Signal Officer, Redstone Arsenal; first vice president, Scears Lee, Jr., district sales manager, Southern Bell Telephone Company; second vice president, Ed Hildreth, chief of communications, Marshall Space Flight Center; secretary, Lieutenant Colonel Ben Holmes, AOMC signal center; and treasurer, J. M. Street, Jr., district engineer, Southern Bell Telephone Company.

Jerome J. Weaver, area manager, Sylvania Electronics Systems, was ap-

Redstone-Tennessee Valley—Officers shown at a recent meeting are (L to R) J. M. Street, treasurer; S. Lee, Jr., 1st vice president; Col. E. J. Dotson, president; E. Hildreth, 2nd vice president; and Col. B. Holmes, secretary.

pointed chairman of the membership committee. Seventy-five members have been enrolled to date.

W. Kelley Mosley, vice president, Region C, AFCEA was guest speaker.

REGION D

Lawton-Fort Sill

At a dinner meeting held at The Polo Club at Fort Sill, Oklahoma, the following were elected officers for the coming year: president, Lieutenant Colonel Laurence W. Ash; vice president, Charles P. Crawford; vice president programs, Orval S. Weaver; vice president scientific education, John A. Frampton; vice president membership, Robert C. Bruner; secretary, Lynn W. Russell; treasurer, Captain Robert M. Kersbergen.

Following election of officers, Bill Robinson, and Dick Obarski of Intercontinental Electronics Corporation presented a program on closed circuit television distribution systems. After the program, members and guests examined components of the system which were on display.

PACIFIC REGION

Philippines

A luncheon meeting was held September 1 at the Claude Thorp Post, American Legion, Clark Air Base. Robert A. McLellan, Resident Engineer-in-charge, Project Betty, Clark Air Base, was guest speaker. Mr. McLellan presented a comprehensive discussion of satellite tracking operations and its relationship to mapping. He extended an invitation to chapter members and their guests to visit the Project Betty operating site.

Lieutenant A. W. Hall, chapter president, extended an invitation to all members to visit the STARCOM Philippines installations.

CHAPTERS AT LARGE

Alaska

A buffet luncheon meeting was held on May 3, at the Officers Open Mess, Fort Richardson, Alaska. There were forty-three members present.

Colonel Harold L. Hughes, president, announced the resignation of chapter secretary, Ralph E. Witsiepe, due to pressing business requirements. John Harris of the Anchorage Telephone Company was appointed to take Mr. Witsiepe's place.

Association News

Executive Committee Meets

The first meeting of the executive committee of AFCEA under the leadership of Frank A. Gunther, who was elected president at the recent AFCEA 15th National Convention, was held in the offices of the Teletype Corporation, Pennsylvania Building, Washington, D. C., September 28.

Among other subjects which appeared on the agenda for the meeting were the following: the AFCEA budget for the coming fiscal year; the final convention report, plus plans for the 1962 convention; the approval of the charter of the new Redstone-Tennessee Valley Chapter; confirmation of the following newly appointed regional vice presidents: Region A: Robert B. Richmond; Region B1: William Christopher, replacing George C. Ruehl, Jr.; Region B2: Paul H. Clark; Region C: W. K. Mosley; Region D: Major General Harry Reichelderfer to act until his replacement is named; Region E: Walter H. Pagenkopf; Region F: Commander Ray E. Meyers; European Region: Brigadier General Kenneth F. Zitzman; Pacific Region: Brigadier General Douglas Williams vice Lieutenant General Gordon A. Blake. Major General John B. Bestic, USAF, was confirmed as national vice president, replacing General Harold W. Grant, USAF.

Also taken up at the meeting was the financial report for the end of the fiscal year presented by the national treasurer. The staff at National Headquarters gave a report on administration activities of the Association and SIGNAL magazine.

The Executive Committee voted a special tribute of thanks to George C. Ruehl, Jr., who has served many years as Regional B1 vice president, and to Major General Harry Reichelderfer, vice president of Region D. The committee also expressed their profound appreciation to Rear Admiral Frank Virden, and Major General Harold Grant for their cooperation, assistance and support during their period of service as members of the Executive Committee and as vice presidents of the Association.

New Group Members

Brown Engineering Company, Incorporated, and SPACO, Incorporated, both of Huntsville, Alabama, have joined the Association as group members.

New members of the Association named by the Brown Company are Robert B. Anderson, vice president, who will be company representative; Milton K. Cummings, president; Robert M. Stewart, chief systems design and development; Don E. Denton, chief, equipment engineering section;

(Left photo) Col. Murray A. Little (right) is presented the Commanding General's Certificate of Achievement at Fort Monmouth by Maj. Gen. Wm. D. Hamlin, Post Commander. Colonel Little was commended for service as Director of the Armed Services Electro-Standards Agency (ASESA), and as commanding officer of the U. S. Army Element of that Agency since January 1959. (Right photo, L. to R.) Brig. Gen. K. F. Zitzman, USA (Ret.), AFCEA Regional vice president for Europe, presents the certificate of Group Membership of Headquarters ITT Europe to D. A. Lush, executive assistant to the general manager, and A. G. Williams, manager of military marketing. ITT EUROPE, with Headquarters in Brussels, is the first group member located in Belgium.

Charles Gamble, chief, electronics engigineering section; Robert Murey, Jim Hammons, and Glenn Parker, all senior engineers; and William Smollen, project coordinator.

New members named by SPACO, Inc., are John E. Hatch, Jr., president, who will act as company representative; Chester R. Savelle, manager electronics development; Jack Garrett, designer; Pat Lewis, Mel Marine, Roy Scates, all engineers; Rogers C. McCauley, contract coordinator; George F. Epps, engineering manager; William A. Beach, executive vice president; and Billie R. McClure, purchasing agent.

The newly appointed members will all be members of the Redstone-Tennessee Valley Chapter.

New Naval Communications Director Appointed

Rear Admiral Bernard F. Roeder, USN, communications officer and fleet unit commander, will succeed Rear Admiral Frank Virden as Assistant Chief of Naval Operations (Communications)/Director of Naval Communications. The appointment will become effective in early October.

RAdm. Frank Virden, USN

Admiral Virden is a member of the Executive Committee and a vice president of AFCEA.

As SIGNAL goes to press, we have learned that Admiral Virden's new assignment will begin on October 7, when he will become Commander, Cruiser-Destroyer Force, Pacific Fleet.

A tribute to Admiral Virden will appear in a forthcoming issue of SIGNAL.

Harold Kaye Promoted

Harold W. Kaye, AFCEA member and a ham radio enthusiast for 30 years (Call W2KKE) has been named to the new position of Technical Assistant to the vice president and general manager of Adler Electronics, Inc. Formerly manager of customer liaison in the military products division, Mr. Kaye also served as engineering project manager during his ten years with Adler.

Charles F. Horne Promoted

The Association is pleased to announce the appointment of RAdm. Charles F. Horne, USN (Ret.) as president of General Dynamics Corporation's newly combined Electronics and Pomona divisions.

Adm. Horne, a director of AFCEA, will retain his position as a senior vice president of General Dynamics.

Deputy Director of New Defense Intelligence Agency Named

SIGNAL magazine is pleased to note the appointment of Major General William W. Quinn, USA, as Deputy Director of the new Defense Intelligence Agency (DIA).

General Quinn, in his previous assignment as chief of Public Information, Department of the Army, cooperated to the fullest in supplying the Association, SIGNAL magazine in particular, with the latest information concerning the activities of the United States Army.

His choice as Deputy Director of DIA is an excellent one, and we wish him continuing success.

AFCEA Honorary Member

The Association is privileged to announce the acceptance of honorary membership in AFCEA by Brigadier General John A. McDavid, USAF, recently appointed Director for Communications-Electronics (J-6), Joint Chiefs of Staff. Prior to his new assignment, General McDavid was Chief of Communications and Electronics for Strategic Air Command.

We welcome General McDavid most heartily into our organization, and we wish him continuing success.

John R. O'Brien

John R. O'Brien Promoted

The Association is pleased to announce the promotion of John R. O'Brien, vice president of the Military Products Division, Hoffman Electronics Corporation, to a newly created position of Director of Government Relations for all divisions of the Corporation. Mr. O'Brien will continue as manager of the Washington office, which he has headed since 1957.

Mr. O'Brien is the National Treasurer of AFCEA.

The Association wishes him continued success in his new position.

Donald Parris Promoted

Donald Parris, AFCEA member for many years and a strong supporter of the Association, has been named Director of the Office of Industrial Equipment, one of the new groupings of industry divisions resulting from the reorganization of Business and Defense Services Administration (BDSA) under the Department of Commerce.

Mr. Parris has been succeeded by E. MacDonald Nyhen, as Director of the Electronics Division of BDSA. Mr. Nyhen is also a member of AFCEA, and was previously a Lieutenant Colonel in the Signal Corps. He was also with CBS and later International Standard Electric Corporation.

In Memoriam

National Headquarters regrets reporting the recent death of Colonel Burnett R. Olmsted, USA (Ret.). Colonel Olmsted was a former Business Manager of AFCEA.

NEW MEMBERS

Listed below are new members of AFCEA who have joined the Association during the month of August. Members are listed under the chapter with which they are affiliated. Amateur radio operators are listed with their call letters.

Alaska

Capt. Henry J. Boccella, USA
Thomas N. Gilliam
John G. Tryon

Atlanta

Comdr. R. H. Benson, USN
Cdr. Randolph Britt, USN
Joseph C. Seanor, Jr.
Fred C. Siler
Col. Robert Tomlinson, USA

Augusta-Ft. Gordon

2nd Lt. G. T. Anderl, USA
2nd Lt. W. L. Anthony, Jr., USA
2nd Lt. N. K. Arter, USA
2nd Lt. R. Barth, USA
2nd Lt. J. E. Bennett, USA
2nd Lt. J. J. Boettinger, USA
2nd Lt. Sam M. Botts, USA
2nd Lt. Carl C. Bright, USA
2nd Lt. N. J. Calvin, USA
2nd Lt. J. E. Champion, USA
2nd Lt. J. R. Collins, USA
M-Sgt. R. L. Colombo, USA
2nd Lt. C. S. Cook, USA
2nd Lt. J. M. Cothran, USA
2nd Lt. C. F. Craft, USA
2nd Lt. R. T. Davis, USA
2nd Lt. R. J. Dellaripa, USA
2nd Lt. A. Deloach, USA
2nd Lt. Hugh W. Denny, USA
2nd Lt. N. M. DiPilato, USA

2nd Lt. John C. Doane, USA
2nd Lt. G. H. Elliott, USA
2nd Lt. R. N. Ensley, USA
2nd Lt. R. A. Farley, USA
1st Lt. Wm. F. Ford, USA
2nd Lt. D. R. Forshey, USA
2nd Lt. D. S. Frager, USA
M-Sgt. E. J. Gomon, USA
2nd Lt. H. L. Gordon, USA
2nd Lt. Lee P. Hackett, USA
2nd Lt. D. E. Harvey, USA
2nd Lt. B. J. Heywood, USA
2nd Lt. R. G. Hirsch, USA
2nd Lt. D. M. Hudson, USA
SFC E-7 O. C. Jamison, USA
Lt. G. E. Jeansonne, USA
2nd Lt. J. C. Kincaid, USA
2nd Lt. A. Kristiansen, USA
Capt. John I. Lake, USA
2nd Lt. S. Landau, USA
2nd Lt. D. A. Leaphart, USA
2nd Lt. J. C. McGilvary, USA
2nd Lt. J. A. Macstravic, USA
2nd Lt. Ted K. Matsuo, USA
2nd Lt. D. L. Meyer, USA
2nd Lt. Smith L. Miller, USA
WOJG E. M. Morgan, Jr., USA
2nd Lt. Max J. Morgan, USA
2nd Lt. J. R. Newell, Jr., USA
2nd Lt. John A. Newton, USA
2nd Lt. G. F. O'Brien, Jr., USA
2nd Lt. Antulio Ocasio, USA
2nd Lt. V. Panettieri, USA
2nd Lt. L. G. Parrish, Jr., USA
1st Lt. R. R. Patty, USA
2nd Lt. F. W. Perry, USA
2nd Lt. W. E. Pillartz, Jr., USA
Capt. C. B. Poston, USA
Maj. Erastus W. Roberts
2nd Lt. W. C. Roberts, USA
2nd Lt. G. S. Robertson, USA
2nd Lt. J. J. Robinson, USA
2nd Lt. L. A. Rodriguez, USA
2nd Lt. D. A. Rogers, USA
2nd Lt. A. D. Rosenberg, USA
2nd Lt. J. A. Ross, USA
2nd Lt. Paul F. Ryan, USA
2nd Lt. T. R. Schroeder, USA
2nd Lt. Peter Schulhof
2nd Lt. V. Shpndejko, USA
2nd Lt. John D. Sieber, USA
2nd Lt. R. L. Snowden, USA
2nd Lt. Edward H. Sonn, USA
SFC E-7 Billy J. Southern
2nd Lt. Michael A. Stein
2nd Lt. D. R. Stoddard, USA
2nd Lt. K. E. Strachman, USA
2nd Lt. Thomas C. Thomas
2nd Lt. C. G. Wallis, Jr., USA
2nd Lt. E. L. Wax, USAR
2nd Lt. James G. Webber
M-Sgt. E-7 F. E. Williamson, USA
M-Sgt. R. R. Young, USA
2nd Lt. David W. Zdan
2nd Lt. Edgar A. Ziege

Baltimore

Homer P. Davis
Donald L. Peters
R. G. Roush

Boston

Leon I. Bawer
F. D. Langstroth
Louis S. Kurzejewski
E. V. Larson

Central Florida

W. W. Bishop
C. L. Councilman
M. S. Klein
W. E. Love
J. D. Phillips
W. Stubbs

Chicago

Maurice C. Akin
David Ball
Oliver E. Cole
W. J. Cole
W. B. French
Kimiko E. Hayashi
Cmdr. Donald Hempson
Charles Judson
A. G. LeRoy
S. Pfannstiehl
J. Seifner
C. B. Wells

Dayton-Wright

J. O. Fassett
Raymond C. Hieber
Charles H. Meuche

Ft. Monmouth

Lt. Col. W. A. Hamilton, USA
Joseph Nevin

Greater Detroit

Keith R. Kuntson
Alfred P. Miller
John Strand

Greater Los Angeles

Richard E. Johnson
D. A. Morrison
Irl E. Newlan

Hawaii

Brig. Gen. D. E. Williams, USAF

Kansas City

Ray Crockett
Carl G. Heidbreader
Charles White
Lt. Col. H. J. Young, USAF

Lexington-Concord

E. Gottesman

London

Richard G. Hoyer

Marianas

RELE W-1 Alfred G. Howe, USCG

Montgomery

Col. John S. Ross, USAF

New York

Joseph G. Ayers, Jr.
Donald H. Bodell
Saverio P. DiMaggio
V. R. Hatch
M. A. Lynch
W. C. McAtee
Joseph M. Noll
William J. Lahiff
J. W. Lawler
Maj. Ray Smith, USAFR
Maj. H. A. Spielman, USAFR
Raymond Steckel
A. Robert Taylor
R. R. Weeks

Okinawa

William W. Edwards

Orange

William Marks

Philadelphia

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David B. Jacoby

Pittsburgh

T. N. Clark

Redstone-Tenn. Valley

Albert L. Adams, Jr.
Capt. Jack A. Adams, USA
William N. Anderson, Jr.
Maj. Clifford J. Asby, USA
1st Lt. Thomas E. Barrett
Edward E. Bawsel
John H. Beachboard
David W. Bond
George W. Burns
James R. Collins, Jr.
Ransom E. Crawford
Hale E. Cullom
John E. Dickerson
Robert L. Duling
Charles W. Eifler
Alton D. Elliott, Jr.
James H. Erwin
Inous L. Fambrough
Harry W. Farris
Freeman B. Field, Jr.
John P. Garrison
George D. Gowen
Jimmie D. Hammons
Col. A. W. Hill, Jr., USAFR
2nd Lt. R. C. Hilton, Jr.
Willard M. Holmes
James V. Johnston
Robert K. Kemp
Elmo W. Landers
Gerald R. Lewis
Oliver M. Lowery
Lt. Roy H. Lynch
John D. McCance
John A. McKenna
Col. William J. Macpherson
Clyde J. Martz
Clive D. Mathews
CWO Jack W. Nelson, USA
2nd Lt. Frank E. Nix, Jr.
Stephen B. O'Dea
Francis J. Pakulski
Lewis M. Patton
William W. Potter, Jr.
William C. Pruett
Grover A. Pylant
James F. Robinson
Fred V. Sanders
Finis Self
Jack T. Smith
John P. Smith
Robert K. Smith
James L. Standridge
James P. Stoddard
F. W. Taylor
Massey Tolen
Lt. Kryder E. Van Buskirk
Thomas M. Wade
Reynolds W. Washburn
Karl A. Woltersdorf
William H. Yeatman
Robert A. Wells
W. P. York
Cmdr. John G. Zierdt

Rocky Mountain

Col. Charles A. Baril, USAF
Roy A. Haug
John K. Sterrett

Rome-Utica

Michael E. Kinsella
R. Nevin

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San Juan

CWO-3 Jose D. Caro Costas
Epifanio Rodriguez-Velez
Frank A. Yauger

Seattle

Ensign Donald A. Feldman, USCGS
Lt. Robert W. Felts, USN

South Carolina

M-Sgt. E-7 Danny L. Hydrick

Southern Connecticut

William F. Wolfner

Syracuse

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W. H. Herrman
T. Holdiman

Tokyo

Rockne Porter
Edward H. Harwood

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Lester G. Sturgill
James C. Sutton
Mrs. R. W. Swanson
William E. Yost, Jr.

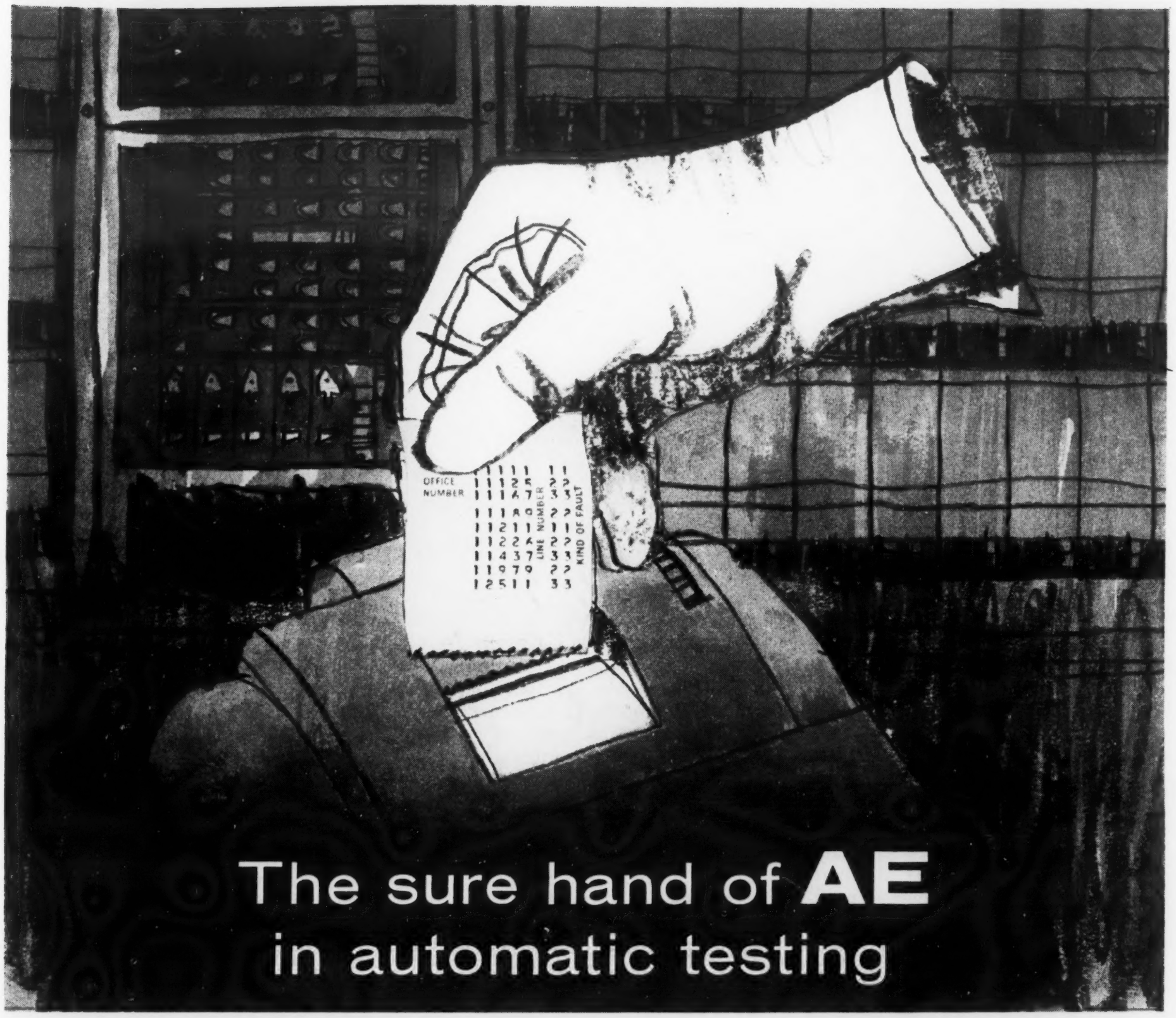
Members at Large

Lt. Robert Goodreau, USN
J. M. Grant
Robert A. Rhodes
Richard E. Odette
W. Serniuk
D. N. Wait

ROTC AWARDS—1961

The Association takes great pleasure in announcing the names of the winners of the Armed Forces Communications and Electronics Association Gold Medal Honor Awards. These medals are awarded annually to outstanding senior Army ROTC, Navy ROTC and Air Force ROTC students majoring in Electrical Engineering. Selection is made by the Military Staff and the Dean of Engineering of the respective university or college. Some of the criteria for selection include proficiency in education and leadership, moral character, and participation in recognized campus activities—all to a high degree.

A. & M. College of Texas
Joseph C. Wheeler, *Air Force*
Arizona State University
Walter M. Gipson, *Air Force*
Arlington State College
Robert R. Routen, *Army*
Auburn University
Joseph S. Boland, *Army*
Bucknell University
Richard Carl Gawenus, *Army*
California State Polytechnic College
Peter Baldwin, *Army*
Carnegie Institute of Technology
Leo Barry Biagini, *Army*
The Citadel
J. A. Westmoreland, *Army*
Louis A. Wintzer, *Air Force*
Clemson Agricultural College
George P. Crotwell, Jr., *Air Force*
Dartmouth College
Harris Bonar McKee, *Army*
Georgia Institute of Technology
William R. Delks, *Army*
Herbert Franklin Nicholson, Jr. *Navy*
Richard Boozer, *Air Force*
Grove City College
John E. Lewis, *Air Force*
Howard University
Walter G. Stroud, Jr., *Air Force*
Iowa State University
David Russell Voltmer, *Air Force*
Lowell Technological Institute
Robert A. Kiley, *Air Force*
Marquette University
Wayne A. Schaeffer, *Army*
Dennis R. Laack, *Navy*
Massachusetts Institute of Technology
Paul M. Thompson, *Army*
Claude R. Phipps, Jr., *Navy*
Missouri School of Mines & Metallurgy
Thomas Kent Bohley, *Army*
Montana State College
Samuel James Lowman, *Army*
Erlind G. Royer, *Air Force*
Newark College of Engineering
Stanley E. Lamberski, *Air Force*
New Mexico State University
Lloyd C. Braum, Jr., *Army*
North Carolina State College of A. & E.
Billy Wayne Carter, *Army*
David B. Whitley, *Air Force*
Northeastern University
Paul J. Browinski, *Army, Senior*
Richard F. Gavin, *Army, Junior*
Robert L. Dacy, *Army, Sophomore*
David I. Walsh, *Army, Freshman*
Norwich University
George F. Donovan, *Army*
Ohio State University
Thomas R. Watkins, *Army*
Allan W. Thompson, *Navy*
Roger L. Lowther, *Air Force*
Ohio University
Donald Nicholas Solar, *Army*
Oklahoma State University
David Shelton Shanks, *Army*
Billy G. Halstead, *Air Force*
Pennsylvania Military College
John E. Bauer, *Army*
Pennsylvania State University
James B. Eshelman, *Air Force*
Polytechnic Institute of Brooklyn
Leo E. Foley, *Army*
Princeton University
Douglas R. Renley, *Navy*
Purdue University
Richard K. Berry
Melvin H. Chiogioji, *Navy*
Clyde R. Sorensen, *Air Force*
Rensselaer Polytechnic Institute
Stephen D. Eitleman, *Navy*
Rice Institute
Harry H. Lynch, *Army*
John Burford Lowe, Jr., *Navy*
Stanford University
Robert M. Wylie, *Army*
Ronald A. Ledgett, *Navy*
Norman K. Swope, *Air Force*
Syracuse University
Oleg V. Fedoroff, *Army*
Tennessee Polytechnic Institute
Denton Eugene Gentry, *Army*
Texas Western College
Patrick Awalt Bowman, *Army*
Tufts University
Stephen Sidney Karp, *Navy*
Tulane University
Henry R. Chambers, *Army*
Richard J. Floreani, *Navy*
Leander A. Lorio, Jr., *Air Force*
University of Akron
James Donovan Markov, *Army*
University of Alabama
James W. Colbert, *Army*
University of Alaska
Charles H. Stump, *Army*
University of Arizona
Robert Paul Taylor, *Army*
University of Arkansas
David Felix Gruenewald, *Army*
University of California
James L. Peirce, *Army*
University of Cincinnati
Ronald L. Loesch, *Air Force*
University of Colorado
Thoms Arvid Clark, *Army*
University of Connecticut
Thomas J. Quigley, *Air Force*
University of Dayton
Stephen W. Soller, *Army*
University of Detroit
Ronald H. Huss, *Army*
Robert M. O'Toole, *Air Force*
University of Florida
Gordon J. Canning, *Air Force*
University of Idaho,
Frank R. Slavik, *Army*
Richard A. Rene, *Air Force*
University of Illinois
Dennis C. Hall, *Army*
Thomas A. Fournie, *Navy*
University of Louisville
Stuart L. Stauss, *Air Force*
University of Maryland
Albert W. Small, *Air Force*
University of Michigan
Fred Nemacheck, *Army*
Richard E. Siemon, *Navy*
University of Minnesota
John J. Igel, *Army*
Donald L. Gustafson, *Navy*
Roger A. Torkelson, *Air Force*
University of Nevada
Clifford Newton Burraus, *Army*
University of New Mexico
Paul B. Dailey, Jr., *Navy*
University of Notre Dame
John P. Keegan, *Army*
John Joseph Flynn, *Navy*
University of Oklahoma
Luther I. Tatus, Jr., *Navy*
Barney L. Capehart, *Air Force*
University of Pennsylvania
Robert Wayne Harris, *Navy*
University of Rhode Island
Daniel M. Viccione, *Army*
University of Scranton
James M. Basta, *Army*
University of South Carolina
William H. Beha, *Navy*
University of Southern California (LA)
Robert G. Mahan, *Navy*
University of Tennessee
Thomas J. Paulus, *Army*
University of Texas
Jerry D. Erwin, *Army*
Benjamin C. Barker, Jr., *Navy*
Clovis R. Hales, *Air Force*
University of Utah
Robert Joseph Nagle, *Navy*
University of Virginia
Terry A. Tucker, *Air Force*
University of Washington
William J. Wilson, *Air Force*
University of Wisconsin
Richard W. Gerber, *Army*
University of Wyoming
Michael T. Rodda, *Air Force*
Vanderbilt University
Everett Harry Falk, *Navy*
Villanova University
A. Michel Clement, *Navy*
Virginia Military Institute
Christopher Walz, *Army*
Kenneth J. Ayala, *Air Force*
Virginia Polytechnic Institute
J. Barclay Andrews III, *Army*
Linden R. Albright, *Air Force*
West Virginia University
Charles W. Shafer, Jr., *Air Force*
The Youngstown University
Thomas B. Williams, Jr., *Army*



AE is an old hand at developing specialized automatic communications devices and systems with unusual capabilities.

A typical example is the Automatic Line Insulation Routiner for the continuous, sequential testing of telephone lines. This unattended trouble-shooter tests lines for crosses, shorts and grounds—camps on a busy number until it is free—registers a fault by printing it on a paper tape roll!

Complex detailing and routining such as this are a logical extension of AE's long experience in the design of systems for dial telephone exchanges and military communications equipment.

If you have a tough problem in communications or control, AE can supply the answers—and provide the components or complete control systems to wrap it up. A letter or phone call (FIllmore 5-7111) to the Manager, Government Service Division, Automatic Electric Sales Corporation, Northlake, Illinois, will bring quick results.

AUTOMATIC ELECTRIC

Subsidiary of

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

AE CAN DO

MAKING IDEAS WORK AUTOMATICALLY

NEWS ITEMS AND NEW PRODUCTS

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The following ships will be awarded on a competitive basis to qualified private shipyards for new construction: 1 submarine tender, 1 guided missile frigate (nuclear powered), 3 guided missile frigates, 3 attack submarines (nuclear powered), 3 escort ships, 3 guided missile escort ships, 1 combat store ship, 1 hydrofoil research ship, 2 oceanographic research ships, 1 surveying ship, 7 landing craft swimmer reconnaissance, 5 submarine repair berthing and messing barges, 4 large harbor tugs. One missile range instrumentation ship will be awarded to a qualified private shipyard for conversion.

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The number of telephones in the United States continues to increase, the Business and Defense Services Administration, U. S. Department of Commerce, has reported. The net increase in 1961 is expected to approximate 2,500,000, bringing the total number to approximately 76,800,000 by the end of the year.

The independent telephone operating industry is composed of approximately 3,300 companies and is augmented by the 23 companies comprising the Bell System. The activities of the industry are influenced to a great extent by developments in the U. S. economy and follow the trend of the Gross National Product, though lagging somewhat behind because of the lead time required by custom production.

The pickup in general business conditions starting this spring has been and is being reflected in the growth of the number of telephones. This rate of growth during the first half of 1961 is 1,000,000, or about 60 percent of the growth during the same period of 1960. The total number of telephones in service in the United States on June 30, 1961, was 75,357,000.

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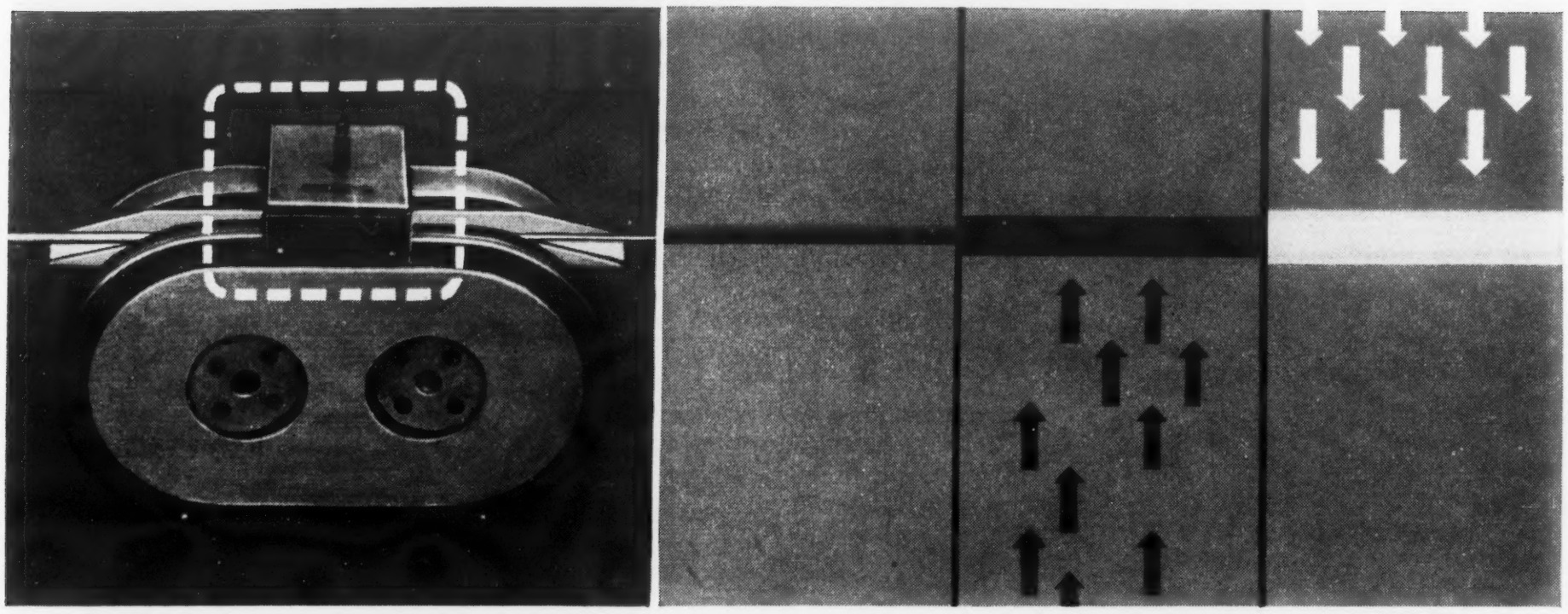

Western Electric's multicoat extrusion line is centered around this common extrusion head (in dotted box) which sheathes . . .

. . . 0.036" diameter copper conductor with . . .

. . . a 0.020" coating of polyethylene insulation . . .

. . . and 0.010" PVC outer jacketing—in one operation.

Western Electric engineers devise a unique extrusion line that simultaneously insulates and jackets copper conductor wire with two dissimilar plastics

One of Western Electric's many jobs as manufacturing and supply unit of the Bell Telephone System is to produce rugged rural wire for sparsely populated localities and for prompt restoration of service in areas hit by storms, fires, or floods. Since the demand for this wire has been steadily increasing, Western Electric engineers sought a way to make it faster, better, and at lower cost.

Previously, two separate extrusion lines were used to sheathe the copper conductor with dissimilar plastic materials. One line applied a black layer of polyethylene insulation; the other applied an outer colored jacket of polyvinyl chloride (PVC) for extra protection and color coding (polyethylene used for color coding purposes will not "weather" satisfactorily).

In coming up with *one* production line to do both coating jobs, Western Electric's engineers had to overcome many manufacturing and engineering obstacles. Since the operating temperatures of the two plastics differ by approximately 100° F, special water cooling and thermocouples had to be provided for the extrusion screws to control these temperatures and to guard against scorching certain PVC compounds which are heat-sensitive. And plastic pressures of approximately 5000 lbs./sq. in. and 2500 lbs./sq. in. for the polyethylene and PVC, respectively, were needed for the operation.

The engineers at Western Electric's Baltimore Works solved these problems by designing and building a unique, *single* extruding head (containing an ingenious set of extrusion dies)—and associated equipment—which simultaneously applies polyethylene and polyvinyl chloride compounds on the copper conductor at the rate of 1600 feet per minute and at precisely the correct temperatures and pressures.

Over-all results to date of the multicoat, common-head extrusion line are: a higher quality, more uniform product...half as much operating space required...about 40% saving in investment costs as against conventional equipment...and substantial operating economies such as reduced scrap, lower maintenance, and a more effective utilization of labor. Furthermore, the simultaneous extrusion process is already being applied by Western Electric to the manufacture of other types of double-coated wire needed in ever-increasing quantities by the Bell System.

One more example of how Western Electric's creative engineering is contributing to America's rapid progress in communications.

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MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

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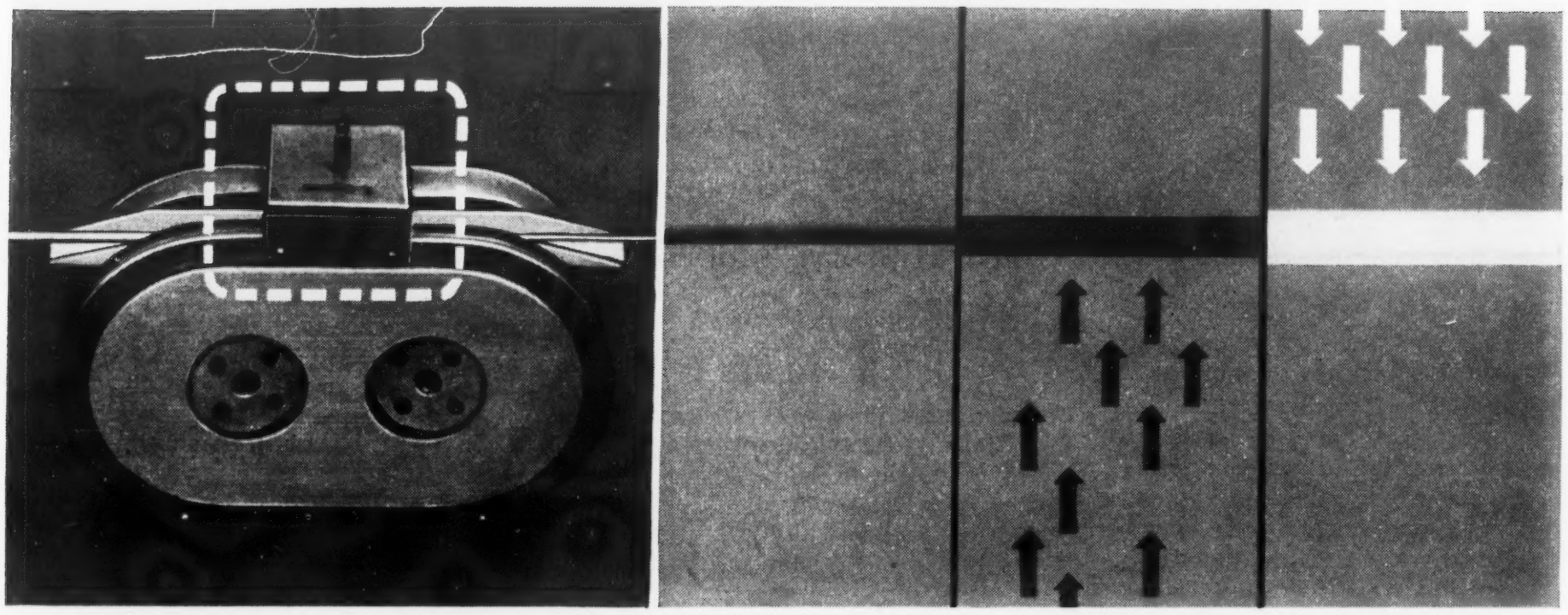

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dataphone services, teletype service, leased facilities, "telpak" services and "centrex" service.

The expanded services, the increase of population, the usefulness of the telephone, and improved business conditions are all favorable factors for a continued upward movement of the telephone industry. The number of telephones, local and toll calls, and revenue will all reach new highs in 1961. The total telephone plant investment at the end of 1960 was almost 29 billion dollars, and should be greater at the end of 1961 because of the continued expansion program.

• • •

Two types of high-speed punched tape transmission equipment are planned by the Bell Telephone System. They are part of the new Dataspeed service which can handle 1,050 words a minute. The equipment will provide service tailored to specific needs. Error detection and automatic correction will be available in future units for applications requiring these refinements.

The Dataspeed tape-to-tape senders and receivers have a capacity of 105 characters a second on a five through eight-level basis and will be able to handle most types of punched tape. Type 1 Dataspeed service, for five-level teletypewriter tape only, will be available toward the end of 1961. Type 2, for five through eight-level punched tape, is scheduled for the first quarter of 1962. It is expected that equipment with error detection and automatic correction features will be introduced in late 1962 or early 1963.

The Dataspeed system can be used alternately with voice services by businesses having existing Bell System leased lines since only a minimum of line-time will be required for transmission of volume data. An ordinary 50-word message or its equivalent in business data can be sent in less than three seconds. Dataspeed tape senders and receivers also can use Data-Phone service over ordinary telephone lines at regular long distance rates.

• • •

An electronic instrument that detects trace quantities of toxic and explosive gases in the atmosphere is described by its developer, American Systems Inc., Hawthorne, Calif., as a basic aid to industrial safety specialists in the missile field and to public health authorities concerned with air pollution control.

The instrument, termed the Olfactron, because it is essentially an electonic nose, is adjusted to signal an alarm when the gas reaches a pre-established level of concentration. As gas enters the chamber, the Olfactron needle moves in proportion to the level of vapor present. At the point when the concentration expressed in parts per million of vapor equals the preset level, the Olfactron signals the warning system electronically, causing a horn and flashing-light alarm circuit to come into action. The basic electro-chemical principle involved is that the vapor sensed produces a proportional electric current, which in turn can be indicated on a meter, or recorded.

The company reports that because they are quick reacting, continuous measuring devices, they can be readily incorporated into electronic warning systems. The instrument is designed for use at missile installations and at other locations where propellants are manufactured, tested, transported or stored. Two such instruments have recently passed extensive field tests at a rocket engine test site.

The physical detection principle of the Olfactron is also being applied to the monitoring of trace quantities of many other gases and vapors having critical toxic, explosive, or odorous properties. Among such substances are borane, also a missile fuel, and sulfur compounds sometimes present in natural gas transmission systems.

• • •

The new Atlas computer, developed by Britain's Ferranti Ltd., can, in practice, perform about a million simple operations (additions, for example) per second. More complex operations, (like multiplication) are performed at about 300,000 per second. The machine has a word length of 48 binary digits and this can be used for fixed-point numbers (40 digits long), for floating-point numbers (8 digits for the exponent), for alpha-numerical data (eight 6-bit characters) or for program instructions (10 digits for the function part, the rest for various addresses).

In Atlas the whole job of storage "house-keeping" is taken over by a built-in automatic system which operates at electronic speed. As a result the programmer does not have to think about two distinct stores but simply works as if there were just one high-speed, single-level store of large capacity.

• • •

Under contracts totalling $1,651,000 Radiation at Stanford, Palo Alto, California, a subsidiary of Radiation Inc., is building two 100,000-watt cw X-band transmitters and 1,000,000-watt power supplies for the Haystack antenna system being built for the U. S. Air Force in Tyngsboro, Mass. (See SIGNAL, June, 1961, page 56.)

The radio research facility, employing a 120 ft.-wide, saucer-shaped antenna with a surface contour of high accuracy, will be used for global and space studies when completed by the end of 1962. Project West Ford, the experiment to reflect radio signals from an orbital belt of metallic fibers, is expected to begin tests at the facility.

• • •

A mass-production process for rapid and continuous growth of crystalline niobium-tin, a compound superconducting material, has been developed by the Radio Corporation of America. This material possesses an ability to generate and sustain very strong magnetic fields without any power dissipation. Magnets made with the material will continue to operate indefinitely without consuming any power except for a small initial voltage to start a current flowing.

The RCA laboratory apparatus is capable of producing uniform crystal coatings of niobium-tin on a fine wire at the rate of 30 feet per hour. Production refinements are expected to increase this rate.

Niobium-tin has unusual properties as a superconductor. The compound has been found to remain superconductive at somewhat higher temperatures than do any other known superconductors and in far stronger magnetic fields. For this reason it has been regarded as a possible source of extremely high magnetic fields that can be sustained without consuming very large amounts of power.

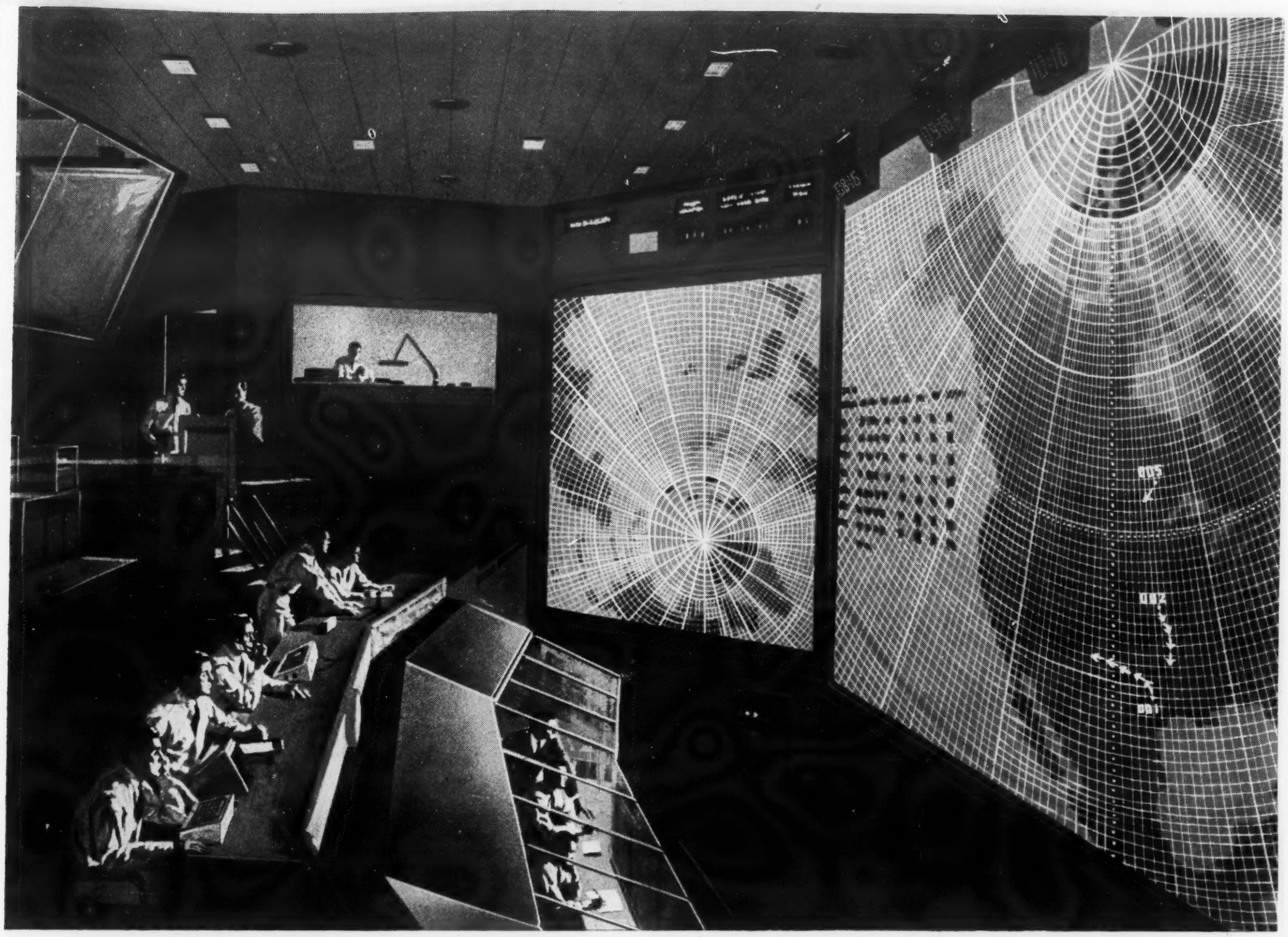
• • •

Radio Corporation of America has announced development of electronic equipment for transmitting data to a computer thousands of miles away at a pace 3,000 times faster than by teletypewriter.

RCA magnetic tape terminal units have been installed at San Francisco and Kansas City to speed social security data halfway across the United States from the California city to an RCA 501 computer system at Kansas City. Computer-processed facts and figures are relayed back to San Francisco the same day.

"The only real speed limitation on the equipment," an RCA official said, "is that imposed by the operating rate of the communications medium used, whether normal telephone facilities, leased lines or microwave. It is possible to transmit more than 18,000 data characters in a single second with existing public carrier facilities."

A version of the equipment would permit operation at even higher speeds, such as at the 66,000 charac-



NORAD ON THE ALERT

Inputs from BMEWS Provide Instantaneous Missile Data Direct to NORAD Headquarters

From our vast outer defense perimeter, over thousands of miles, to the nerve center of the North American Air Defense Command at Colorado Springs, the most advanced concept of data handling and checkout is being utilized in the BMEWS system. The stakes are high, for the purpose is defense of the North American Continent.

At BMEWS installations operated by USAF Air Defense Command, computers read out missile tracking data from giant radars. This information is simultaneously relayed to NORAD's Combat Operations Center.

The Radio Corporation of America is prime systems contractor for BMEWS. At the COC, RCA's Display Information Processor computing equipment automatically evaluates missile sightings, launch sites and target areas. By means of data processing and projection equipment installed by RCA and a team of other electronics manufacturers, the findings are displayed on huge, two-story high map-screens in coded color symbols, providing the NORAD battle staff with an electronic panorama of the North American and Eurasian land masses.

The handling of BMEWS inputs at NORAD is an example of how RCA data processing capabilities are assuring the high degree of reliability so vital to continental defense.

Out of the defense needs of today a new generation of RCA electronic data processing equipments has been born. For tomorrow's needs RCA offers one of the nation's foremost capabilities in research, design, development and production of data processing equipment for space and missile projects. For information on these and other new RCA scientific developments, write Dept. 434, Defense Electronic Products, Radio Corporation of America, Camden, N. J.

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ters per second rate of modern computer magnetic tape transports.

In use, the equipment works with the Bell System's Dataset 201A at each end of the private line telephone circuit. AT&T and Associated Bell Company personnel were instrumental in the setting up of the new facility. Data is relayed through the MTT's magnetic core memory to standard telephone, leased line, or microwave hookups. At the receiving end, the information once more passes through magnetic core memory and on to a magnetic tape unit for recording and computer processing. The use of core memory provides the highest rate of line efficiency by blanking out tape gap time.

The operator at the sending end can dial the receiving point directly, receive confirmation that a connection has been established and start data transmission by pushing a button on the MTT control panel. Voice communications between sending and receiving operators is possible, without affecting the recording of basic data.

• • •

A fuel cell which can directly convert heat to electricity at efficiencies exceeding 50 percent has been developed by the Armour Research Foundation of Illinois Institute of Technology. The system operates on solar heat, nuclear sources or from waste heat sources.

The cell uses a prepackaged chemical system. The heat converts the chemicals for the generation of electricity. The electrical power is then taken off while the chemical is cooling. Portions of the spent chemicals are regenerated by the heat source and they are again available for the generation of electricity.

• • •

Senator George Smathers (D., Fla.) dedicated the new plant of Rixon Electronics, Inc., in Montgomery Industrial Park, Silver Spring, Maryland, last August.

The new plant cost in excess of $500,000 and occupies 30,000 square feet with 70,000 additional square feet planned for the future. It contains complete manufacturing, engineering and administrative facilities for a staff of more than 150 persons.

• • •

Burroughs Corporation has delivered to the Navy an ultra-miniaturized electronic three cubic foot airborne digital computing system. Computational ability is reportedly the same as a conventional room size computer. The advanced system is a solid-state general-purpose computer designed as a central computer for fire control and navigational uses.

The Burroughs D-202 weighs less than 190 pounds and excluding input-output equipment occupies three cubic feet of space. Silicon transistorized circuitry is employed. High packaging density is achieved through the use of replaceable circuit modules, called Logi-Mods, averaging 19 electronic components encapsulated in a volume of ¼ cubic inch.

A three-inch magnetic drum, rotating at 12,000 rpm and capable of holding 215,000 bits of information, serves as the permanent memory and storage of constants. A linear-select, random access ferrite core memory of 11,500 bits is used for initial conditions and temporary data storage. A multi-winding principle is used in the core memory design to reduce the memory electronics, conserve power and reduce physical size.

The basic clock rate of the computer is 1.33 megacycles. Operating speed is quoted at 10 microseconds add-and-subtract times, and a 40-microsecond multiply time.

• • •

Lenkurt Electric Co., Inc., has available a new panel for automatic frequency synchronization and signal level regulation on Channel 1 of its stackable three-channel Type 33A multiplexing system.

The new product is designated the Type 331A Channel 1 Regulator Panel. Regulation circuitry effects a five-to-one ratio of output improvement over received line signals. Absolute synchronization is produced.

The panel was developed to meet the new requirements of frequency shift telegraphy, which is scheduled for large-scale nation-wide use next year in the Bell System's mechanized TWX program.

• • •

An 8½-inch electrostatic charge printing tube which reproduces charts, photographs, numbers and words at the rate of 10,000 lines per minute was shown by Sylvania Electric Products Inc., at the 1961 Wescon Show in San Francisco.

The new tube, Type SC-3075, uses magnetic deflection and focus. The writing area of the tube face plate consists of 85,000 wires, .001 inch in diameter, spaced 250 wires per inch.

• • •

Systems Engineering Laboratories, Inc. (SEL) of Ft. Lauderdale, Florida, has produced a new analog-to-digital converter with high stability and conversion rate input impedance coupled with low power consumption.

The new coder is designated the SEL Model ADC-1B and uses standard voltages, circuits and logic throughout. The bit rate, word length, type of code, voltage range and output format can be changed to adapt the unit to specific applications either as a system component or as a self-contained instrument.

Some of ADC-1B's features are: full 15-bit resolutions; BCD or binary — both serial and parallel output formats; Nixie display of digital output in decimal form indicates polarity and magnitude of input voltage up to 3.999; when ADC-1B is used with a multiplexer in systems configurations any one preselected data channel can be displayed on the Nixies without interrupting the internal coder operation or normal system sequence; solid state throughout; all circuitry contained — no external power supplies required, and rack-mounted or case-packaged.

• • •

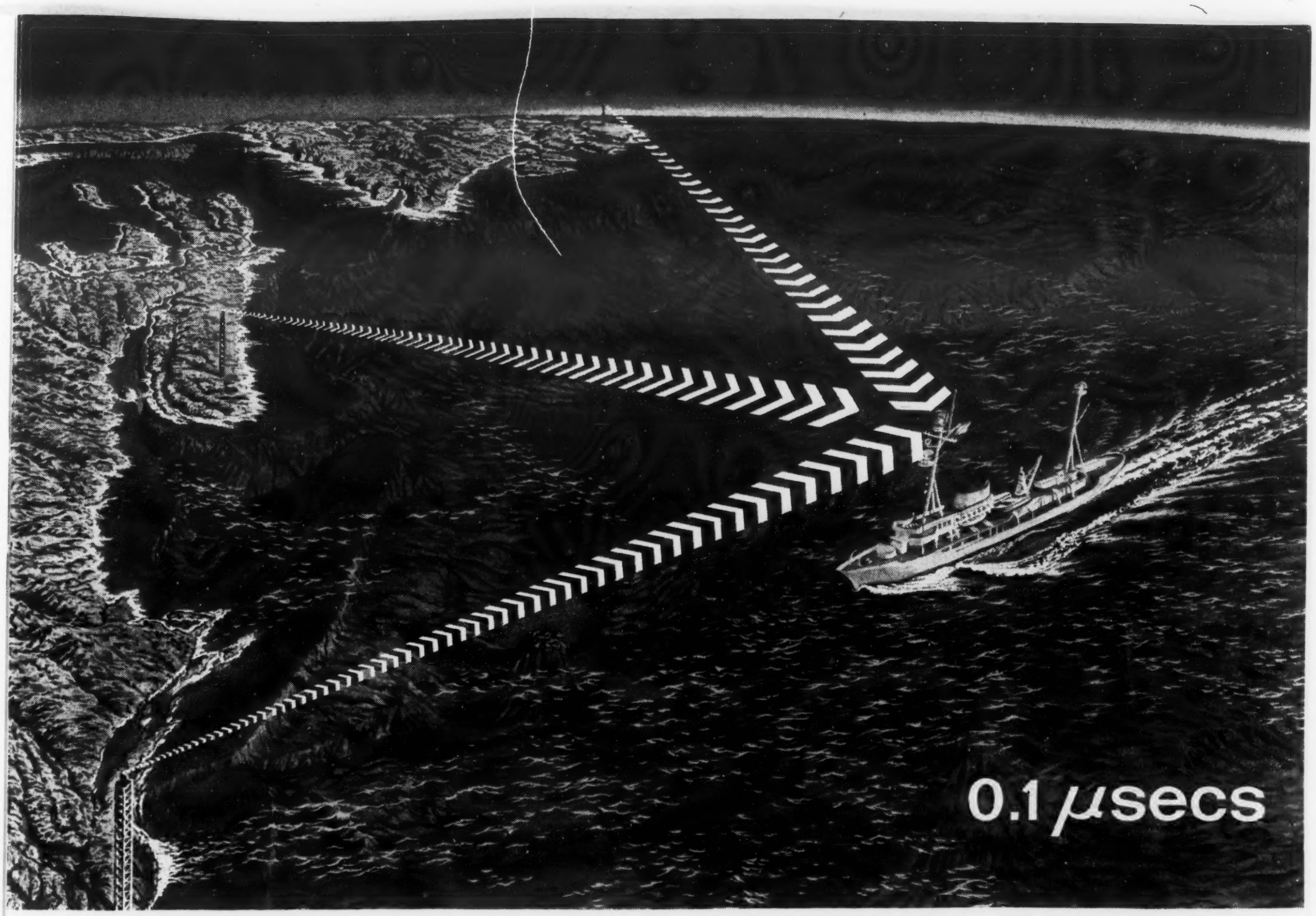
How to maintain management and production continuity in time of nuclear attack was explored in an industry seminar held by the Pennsylvania State University last August. The seminar was part of the Shelter Research and Study Program carried out by the University in cooperation with government agencies.

A feature of the meeting was a case study of how a selected industry can prepare in advance for action in emergency. HRB-Singer Inc., of State College, Penn., served as a test case.

• • •

Space Research and Technology Institute, the University of Maryland, is scheduled for consecutive Monday nights beginning October 9, 1961 and ending on November 27. Lecturers will present latest developments in such areas as propulsion, space flight, communications and space medicine.

The schedule is as follows: *International Astronautics* — October 9; *Tracking and Communication*—October 16, to be conducted by John T. Mengel, Asst. Director, Tracking and Data Systems Directorate, NASA; *Space Operations*—October 23, to be conducted by Kurt R. Stehling, Scientist, Office of Program Planning and Evaluation, NASA; *Space Propulsion*—October 30, by Harold W. Ritchey, Vice President, Rocket Operations, Thiokol Chemical Corp.; *Magnetic Storms and the Aurora*—November 6, by Sydney Chapman, High Altitude Observatory, University of Colorado; *Gas and Dust Near the Earth*—November 13, by S. Fred Singer, Professor, Physics Dept., University of Maryland; *The Exploration of Venus and Mars*—November 20, by A. R. Hibbs, Chief Division of Space Sciences, Jet Propulsion Laboratory; *Bioastronautics*—November 27, by Don D. Flickinger, Brig. Gen.,



Precise position? Precise time? Loran C provides both. For example, three million square miles of the Pacific's unexplored areas are today being charted with an accuracy never before possible—by two U. S. Coast and Geodetic Survey ships navigating with an advanced Sperry Loran C system. By measuring to fractional microseconds the arrival time of radio signals, it gives oceanographers their precise position constantly in all weather.

Used in conjunction with the Naval Observatory's Atomic Clock, the National Bureau of Standards has proven Loran C to be the nation's most accurate long range time distribution system. It will play a vital role in inter-range missile and satellite tracking. General offices: Great Neck, N. Y.

Some other uses of Loran C: air traffic control; anti-submarine warfare; air-sea rescue; airborne early warning station keeping.

USAF, MC, Assistant for Bioastronautics, Andrews Air Force Base.

For further information and registration contact Director of Institutes, University College, University of Maryland, College Park, Maryland. A registration fee of $35 per person includes the entire series of eight sessions.

• • •

The National Company of Malden, Mass., has developed an Electron Bombardment Detector which produces positive ions from neutral atoms. By revealing the presence of positive ions, a means of detecting carbon monoxide particles has been achieved by the company.

Carbon monoxide beam detection will, it is hoped, make it possible to increase the accuracy levels of atomic primary frequency standards by as much as ten, or perhaps, one hundred times.

National Company has been working under Air Force contract sponsored by the Rome Air Development Center to determine the feasibility of using carbon monoxide for a primary frequency standard for a year. A new contract to continue this work has recently been awarded the company.

• • •

The L-3060 computer system developed by General Precision's Librascope Division can perform 2,480,000 operations per second and retrieve information from memory in less than a millionth of a second.

The transistorized system is a digital, multiple-computer system. It has high-speed core memory access to 144,000 words, random access to 3,250,000 words stored in magnetic disc files and magnetic tape storage files of 9,000,000 words. The random-access information can be retrieved in 17 thousandths of a second and all files are expandable.

• • •

Minneapolis-Honeywell has developed a thermoelectric generator made of ceramics. Designed for use by the U. S. Army, the generator is capable of operating at temperatures up to 2400° F. Output of the new generator is 1,000-1,200 microvolts per degree Centigrade, compared with 250-300 for intermetallics. The pilot model delivered to the Army's Picatinny Arsenal at Dover, N. J., is designed to deliver 100 volts under no load.

The generator uses nickel oxide with a reference of platinum. A second generator being built by Honeywell for the Army will also employ the nickel oxide, but will substitute iron oxide for the platinum, producing even higher voltages.

Several relatively inexpensive phototransistor tachometers have been developed by the Navy to accurately measure the spin rate and decay rate of spin of miniature missile models revolving as slow as two rps in a supersonic wind-tunnel airstream. The tachometers were invented by Charles F. Miller, an aeronautical research engineer at the U. S. Naval Ordnance Laboratory, to collect data on the aerodynamic stability of various missile configurations.

Two variations of the tachometer have components small enough to mount inside a missile model. Components of three other versions of the tachometer are housed in both the model and the sting mount supporting it during a test.

Each of the tachometers consists of a light source, a phototransistor and a perforated wheel or some other means of periodically interrupting the light beam shining between the first two components. When the perforated wheel is attached to the tail of a revolving missile model, the series of light pulses passing through the perforations in the wheel hit the phototransistor and change its resistance. This results in a series of electrical signals which are counted per unit of time to determine the revolving model's spin rate or damping rate of spin.

• • •

Raytheon's Cybertron is a special purpose machine designed to aid the development of a highly advanced learning machine. Cybertron K200, now in final stages of development, is a large learning machine designed to recognize speech sounds. When fully developed it will recognize and type out all typical American word sounds through use of its 192 learning elements.

The Cybertron K100, a small machine, uses punched tapes for learning as well as for its memory element. A tape of about one foot long stores all it learned about dozens of cardiograms and sonar identification.

• • •

Bendix-Pacific Division of The Bendix Corporation displayed at the 1961 Wescon Show a system that combines telemetry with sonar to provide cableless underwater communication.

The system uses existing equipment with few modifications. A range of up to five miles with one percent accuracy has been achieved, with as many as 10 continuous subcarrier channels, officials said.

The system is in principle similar to those used in airborne applications. Data information frequency modulates subcarrier oscillators, which in turn frequency modulate a carrier. The carrier operates on any IRIG channel from 10.5 kc to 52.5 kc. The carrier frequency is amplified to a power level required for transmission and drives a sonar projector. The projector converts the electrical signals into sonic waves in the water.

At the receiving station the sonic waves are picked up from the water by a hydrophone and converted back into electrical signals. The carrier signal is demodulated by a discriminator into the subcarriers, which in turn are demodulated into data by additional subcarrier discriminators. The data can then be displayed or recorded.

• • •

A device to keep gyroscopes in balance by inducing electrically the proper amount of compensating torque has been patented by Edward J. Mullarkey, president of Avcon Corp., Scarsdale, N. Y.

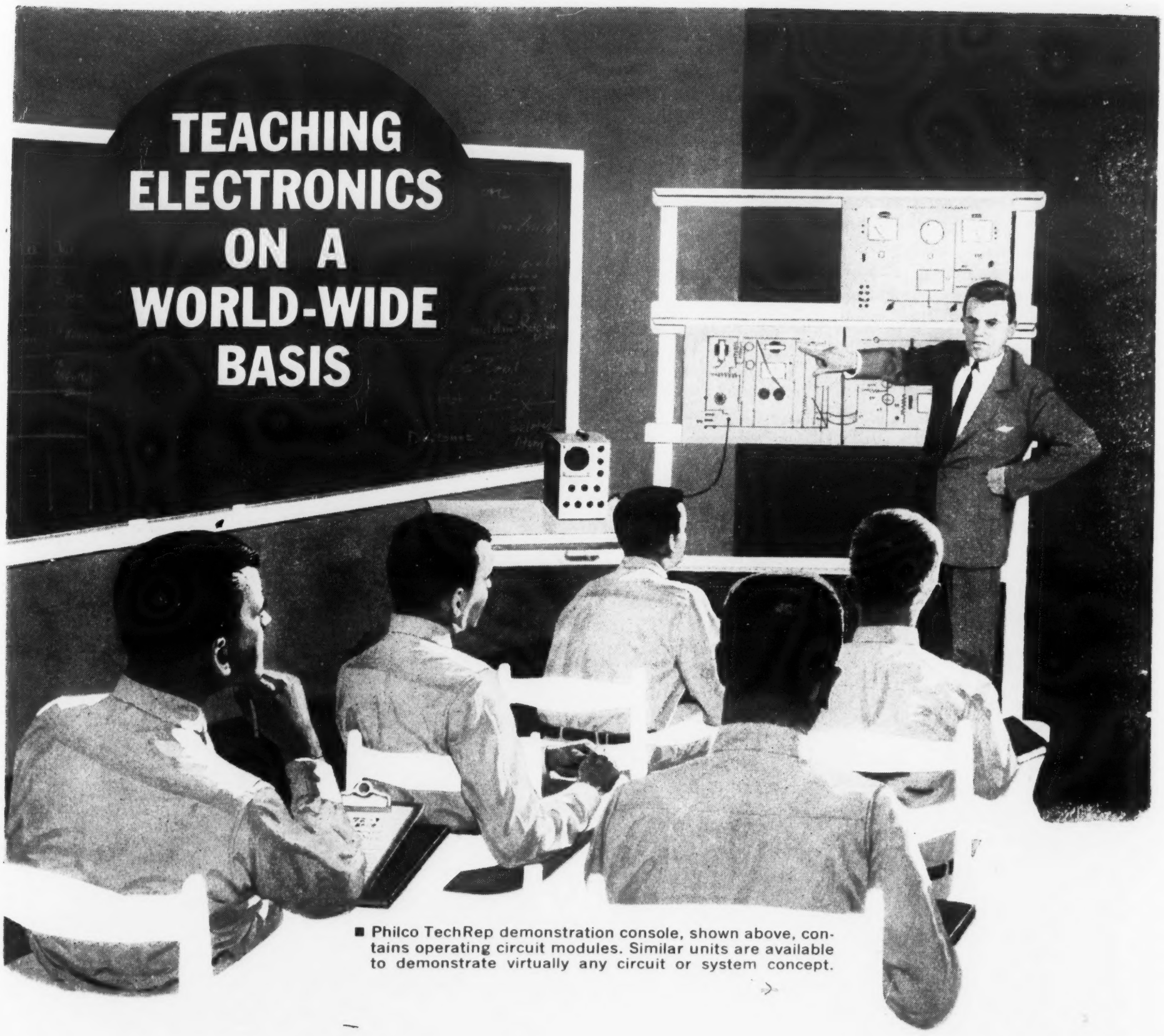
The Avcon Mass Shift Compensator functions as an electrolytic cell with two equal masses of metal aligned at opposite ends of a small glass cylinder filled with a suitable electrolyte. Powered by pure or pulsed DC current of any wave form, molecules of metal can plate from one end of the cylinder onto the metal at the other end. The direction of the plating or mass shift can go in either direction, depending on the polarity of the current. As the relative mass of the electrodes changes, compensating torque is induced and the gyroscope is thus brought back into balance.

Photoprogress

The Naval Ordnance Laboratory has developed for the Atomic Energy Commission a motion picture camera for filming and timing high-speed action simultaneously in color and black and white. Capable of exposing film at 1/50th millionth of one second without losing picture quality, the camera uses a constantly open lens which receives the image and passes it to a revolving mirror. After bouncing the image among other mirrors and through several lenses, the same revolving mirror then sprays the image onto a motion picture film strip.

Recording single frame action at 20 billionths of a second while taking one million frames per second, the camera is 15 times faster than the

TEACHING ELECTRONICS ON A WORLD-WIDE BASIS



■ Philco TechRep demonstration console, shown above, contains operating circuit modules. Similar units are available to demonstrate virtually any circuit or system concept.

Personnel throughout the free world are being trained to teach, operate, and maintain virtually every type of electronic system—through retention-building Philco custom-tailored demonstrations.

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Philco Corporation of Canada, Ltd.,
Don Mills Road, Don Mills,
Toronto, Ontario, Canada

high speed cameras currently in use which take 300 billionths of a second to record the action in one frame.

Credited with designing the framing camera is Dr. Sigmund J. Jacobs of the Naval Ordnance Laboratory.

• • •

Through its Instrumentation and High-Speed Photography Subcommittee on Education, the Society of Motion Picture and Television Engineers has issued a call for information about requirements for the education of high-speed photographers.

In an effort to gather information needed for evaluation of educational requirements for photographic instrumentation in industry and government, the Subcommittee is conducting a nation-wide survey of technical photographers, engineers, scientists and educators. The survey is under the direction of Subcommittee Chairman Max Beard, Chief of the Photographic Division, U. S. Naval Ordnance Laboratory, Silver Spring, Maryland.

• • •

A fully automatic microphotographic camera has been developed by Ernst Leitz. GmbH of Wetzlar. West Germany, and introduced in this country by E. Leitz, Inc., of New York City.

The camera is designed to fit any microscope and has both detail and field integrating exposure mechanisms.

• • •

A special camera has been installed at the Air Force Missile Development Center, Holloman Air Force Base, New Mexico. Consisting of 19 long-barrelled five-inch refracting telescopes linked to as many television-like image-orthicon tubes, the giant camera has been used to photograph missiles, satellites and planets in daylight. The system recently captured continuous bright-image views of Venus and Jupiter in daylight.

Planetary images were transmitted to indoor viewing screens where they were photographed with a precision-plate camera to produce clear, distortion-free pictures ordinarily obtained only during night hours. The total field covered is many times the size obtainable by standard tracking telescopes.

Scanning the heavens at night, the new system has photographed a star cluster, The Peliades, with image resolution of faint stars up to the 12th magnitude.

The number of telescopes and oscilloscope screens will be increased to 25 to complete the planned design of the system and to provide a viewing field of 2½ by 7 degrees.

The system was developed in the Air Force Missile Development Center's Orbital Mechanics Division by Walter E. Woehl, theoretical and applied physicist. The system was built by ITT Laboratories, Fort Wayne, Indiana. The 25 telescopes have been furnished by the E. C. Larr Optics Co., Altadena, California. The 13,000 pound, four axis tracking mount was built by Joseph Nunn and Associates, Pasadena, California.

• • •

A rapid processing machine capable of reducing processing time for television recording film from almost 60 minutes to only 60 seconds has been announced by Eastman Kodak Company.

The Eastman Viscomat 16mm Processor uses chemicals of honey-like consistency to process 16mm motion-picture film at the rate of 36 feet per minute. Elapsed time from developing to drying any single frame of motion picture film is just one minute.

• • •

The 186,000-mile-per-second flight of a light beam has been stopped at several points along its path and photographed by scientists of STL Products Division of Space Technology Laboratories, Inc., using the electronic STL Image Converter Camera (see SIGNAL, March 1961, page 88).

The camera took pictures of the flight of light by an image-sweeping technique, rather than the individual framing method for which it is best known. The achievement was announced and demonstrated August 3 at the University of Southern California.

The photos presented at the University show a flash of light reflected into the camera by a series of mirrors placed before it at successively greater distances from the source of the flash. The camera, adjusted to sweep the image across the film from top to bottom, recorded the reflected light from each mirror as it reached the lens. The camera swept the image at a speed equivalent to 168,000 miles per hour.

To obtain the short-duration light source required for the experiment, the flash was of very low intensity. The camera amplified the light fifty times.

Names in the News

Brig. Gen. Bernard M. Wooton, USAF (Ret.) has been named executive director of Contract Services at Page Communications Engineers, Inc.

M. B. Ruffin has been named president and chief executive officer of Chicago Aerial Industries. **Cecil P. Milne** was elected a director and chairman of the executive committee of the same Company.

Ronald G. Egan has been appointed vice president-Europe by the Western Union Telegraph Co.

E. F. Coy has been named vice president and director of marketing for the Military Products Div. of Hoffman Electronics Corp.

Thomas B. Eastland, Jr., has been elected president and director of the newly reorganized U. S. Infrared Corp. **Philip Luckhardt** of the same Company has been appointed executive vice president and director.

Walter J. Kruel has been appointed president of Hufford Division, The Siegler Corp., El Segundo, Calif.

Edward Bachorik has been appointed executive vice president of Allied Control Co., Inc.

Richard A. O'Brien has been appointed supervisor of reliability and military products for Corning Electronic Components, a department of Corning Glass Works.

Frederick R. Kappel was named chairman of the Board of Directors of American Telephone and Telegraph Co. He will continue as chief executive officer. **E. J. McNeely** is the newly appointed president, and **C. M. Blair** was named a vice president with responsibilities for space and communications programs.

Fred L. Martinson has been appointed vice president of the newly formed engineering and manufacturing division of Electronic Associates, Inc.

Eugene B. Novikoff has been promoted to the newly-established position of vice president of operations, Instruments for Industry, Inc.

Mark Shepherd, Jr., has been elected executive vice president of Texas Instruments, Inc.

RAdm. Harold M. Briggs, USN (Ret.) recently became the president and chief executive officer of Washington Technological Associates, Inc.

Lowell R. Day has been appointed to the newly created position of executive vice president of Packard Bell Electronics. **Leroy E. Lattin**, president of General Telephone Co. of Calif., has been elected a member of the board of directors of Packard Bell.

John J. Graham has been appointed to the newly created position of Division vice president, operations, of the Radio Corporation of America's Electronic Data Processing Div. **Francis J. Dunleavy** has been appointed general manager, Communications and Controls Div., RCA.

OBLIQUE IONOSPHERIC SOUNDING—

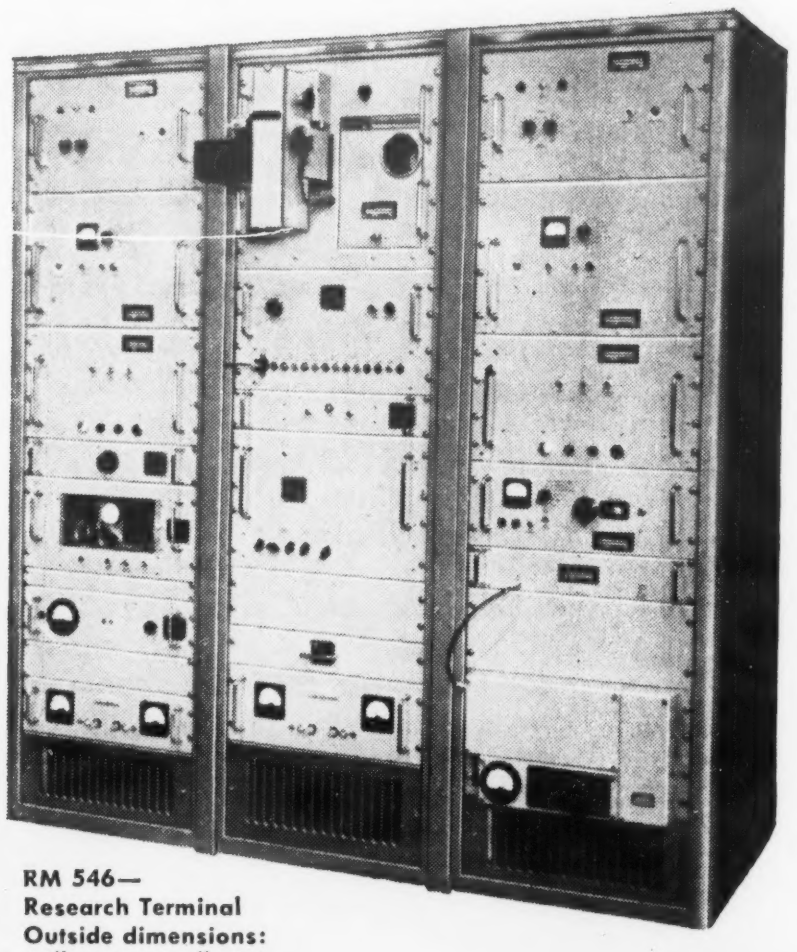
RESEARCH...

Originally designed to a Canadian Defence Research Telecommunications Establishment specification and produced by Philips Electronics Industries Ltd., Toronto, Canada, this *Ionospheric Sounding System* is one recently installed for research projects by the United States Army Signal Radio Propagation Agency, Fort Monmouth, New Jersey. Other Philips Ionospheric Sounding Equipment is being used for research purposes in the U.S.A.F. Cambridge Research Centre; National Bureau of Standards, Boulder; Lincoln Laboratories of M.I.T.; and D.R.T.E. Ottawa. This equipment is helping to prove a new technique in communications reliability.

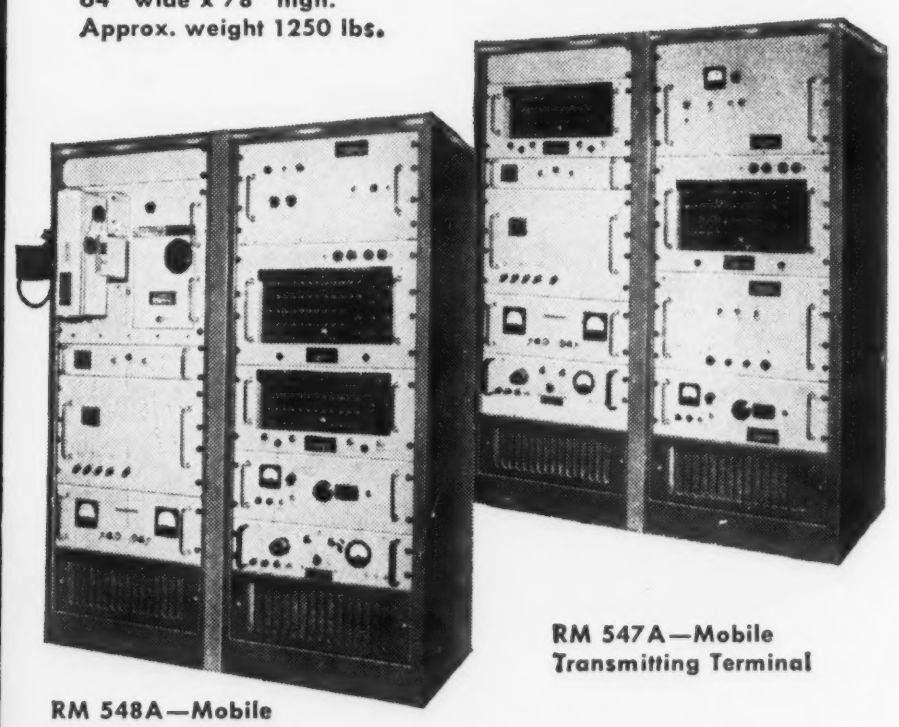
TO REALITY!

To move the equipment out of the area of radio propagation research and into operation, PHILIPS engineers refined the design into this more compact package, maintaining the 8 year field-tested basic design to ensure reliability. Readily transportable and completely automatic, the new Philips Mobile Sounder Receiver System with Display (front) and the Mobile Sounder Transmitter (rear) are versatile and compatible with existing systems, weigh approx. 600 lbs., with outside dimensions of 42″ wide x 52″ high. Despite size and weight reduction, these new mobile Transmitters and Receivers are less expensive and more flexible than the standard models—and do the job under practical field conditions! Everything—from design, supply, antenna installation, and post installation service —is the undivided responsibility of PHILIPS!

For full information on the new Philips Mobile Ionospheric Sounders—or for the engineering help and precision manufacturing facilities to design and produce the most specialized electronic equipment—call PHILIPS!



RM 546—
Research Terminal
Outside dimensions:
64″ wide x 78″ high.
Approx. weight 1250 lbs.



RM 548A—Mobile Receiving Terminal

RM 547A—Mobile Transmitting Terminal

SPECIFICATIONS:

Philips Mobile Ionospheric Sounding Transmitters (Model RM 548A), and Receivers (Model RM 547A).

FREQUENCIES	1—25 megacycles (option 25— 50 Mc. and 1—50 Mc.)*
POWER OUTPUT	10—20 Kilowatts
OUTSIDE DIMENSIONS	42″ Wide x 52″ High. (96″ of 19″ Rack)
GROSS WEIGHT	Approx. 600 lbs.

*Programming times and frequencies are easily adaptable to a wide range of requirements by adjusting the Sounder's Program Control Unit.

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6103

COMMUNICATIONS—ELECTRONICS GLOSSARY

In an effort to provide our readers with a quick reference to frequently used technical terms, SIGNAL is initiating this glossary of communications and electronics phrases. Each month we hope to publish a segment of this list. Readers' comments about the glossary will be welcomed.

amplitude—*the maximum value of a periodically varying quantity during cycle.*

amplitude modulation—*the system of modulation in which the amplitude of the transmitted carrier wave is varied in accordance with the impressed signal; the frequency and phase remain unchanged.*

angstrom—*a unit for measuring the wave lengths of light.*

antenna—*a conductor or a system of conductors for radiating or receiving radio waves. The antenna form ranges from a simple short length of wire for the receiver to an elaborate array of wires or steel towers for large transmitters.*

aphelion—*that point of the orbit of a planet or comet or satellite where it is furthest away from the sun.*

apogee—*that point in the orbit of any celestial body, missile or rocket at which it is at its maximum distance from the earth.*

asteroids—*small bodies which revolve about the sun, mostly between the orbits of Mars and Jupiter.*

bolometer—*an electrical instrument for measuring and recording exceedingly minute changes of temperature. It depends upon the change in resistance of a very thin strip of metal when slightly heated or cooled; can be connected with a telescope or spectroscope to measure the heat of the stars.*

channel—*the band of frequencies, within which a radio transmitter must maintain its modulated carrier signal.*

cosmic rays—*radiations which strike the earth; assumed to originate in intersteller space; consist mainly of electrically charged particles which bombard the earth from all directions in space, with energies ranging from 2,000 to 17,000 million electron volts.*

cryogenics—*the science of physical phenomena at temperatures below —50 C (—58 F).*

Doppler principle — *a principle of physics that, as the distance between a source of constant vibrations and an observer diminishes or increases, the frequencies appear to be greater or less.*

dynamics —*the study of masses and forces. The study of the effect of forces in causing or modifying the motions of masses and producing strains in elastic bodies.*

electromagnetism—*the science of the properties of, and relations between, magnetism and electric currents.*

electron—*the smallest known particle having a negative charge capable of*

isolation and measurement; all charges are exact multiples of this unit of electric charge. A negatively charged particle conceived to be revolving about the nucleus of an atom; there are, in any atom, just as many electrons as there are protons in the nucleus of that atom.

frequency—*the number of cycles per second of a radio wave; these emissions are measured in kilocycles, which denote a thousand waves a second, and in megacycles, which denote a thousand kilocycles a second.*

frequency modulation — *system of modulation in which the frequency of the transmitted carrier wave is varied in accordance with the audio wave.*

gauss—*the standard unit for measuring a magnetic field.*

gyroscope—*a wheel or disk so mounted as to spin rapidly about an axis, and also free to rotate about one or both of two axes perpendicular to each other and to the axis of spin; used as a stabilizer of ships or airplanes or as a steering apparatus.*

interferometer — *any instrument designed for producing and studying interference of two or more trains of waves or beams of electromagnetic radiation of the same range of wavelengths. Unless otherwise stated, the term is usually employed to denote an optical interferometer, i.e., an instrument that separates a beam of light into two (or more) parts which are made to travel different optical paths and are then reunited to produce the alternate light and dark bands that are seen when two beams of homogeneous light overlap and illuminate an identical area.*

ion — *an electrified particle formed when an atom loses or gains one or more electrons; may be produced in gases by the action of radiation of sufficient energy.*

ionosphere—*layers of ionized air extending from 40-50 miles to 175-200 miles above the earth's surface. These layers reflect radio waves and shortwave communication waves, thus making radio and shortwave transmission possible.*

microwave—*an electromagnetic wave having a wave length in the microwave region, which extends from 300,000 megacycles to 1,000 megacycles per second.*

perigee—*that point in the orbit of any celestial body, missile or rocket at which it is at its nearest distance to the earth.*

radio spectrum—*range of frequencies available for communication purposes; extends from 10 kilocycles to 30,000 megacycles.*

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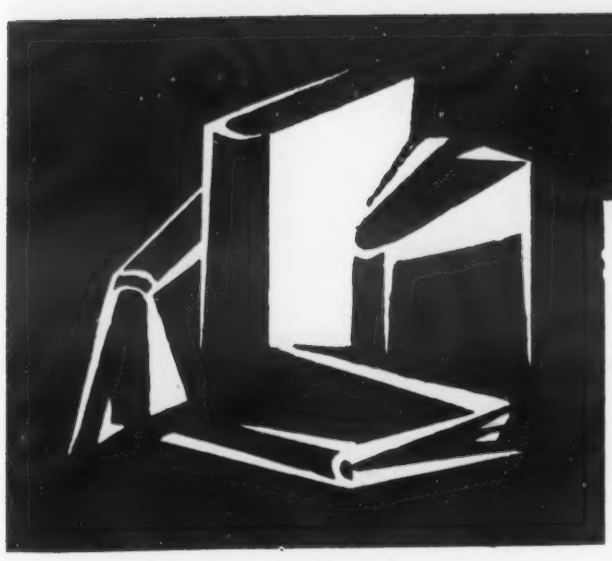
Authors' Index

The numbers in the listing below refer to the number of the articles in the Title Index.



INTERNATIONAL DICTIONARY OF PHYSICS AND ELECTRONICS, Second Edition. D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J., 1961. 1355 pages, $27.85.

The enlarged and revised edition now includes recent developments in such areas as thermonuclear research and magnetohydrodynamics, nuclear physics, astrophysics and electronics. The book has new IRE definitions on networks, computers and other fields and a clear review of the great developments in physics from Newton to such recent discoveries as the nonconservation of parity and work on strange particles.

A multilingual index in French, German, Russian and Spanish is provided.

The terms defined here include laws, relationships, equations, basic principles and concepts, as well as the most widely used instruments, apparatus and their components.

THE COLLECTED WORKS OF IRVING LANGMUIR, 12 volumes. Pergamon Press, 122 East 55th St., N.Y.C. 22, N.Y., 1961. $150.00 per set; $15.00 per volume (1-11); $9.00, volume 12.

Dr. Langmuir, associated with the General Electric Research Laboratory from 1909 until his death in 1957, was the first American industrial scientist to receive a Nobel Prize and is recognized as one of the greatest and most versatile scientific geniuses of the twentieth century.

Because of the broad scope of Dr. Langmuir's scientific interests and the tremendous productivity which characterized his long career, this compilation of his works, both published and previously unpublished, is produced as a set of 12 volumes. Each volume is devoted to one or more fields of service in which Dr. Langmuir worked. His papers are supplemented, with special articles written by other eminent scientists analyzing the influence of Dr. Langmuir's contributions on past, present and future science. The series contains a large number of previously unpublished works, including wartime research and reports on meteorological studies.

Titles of the 12 volumes, listed 1 through 12 respectively, are: Low Pressure Phenomena; Heat Transfer —Incandescent Tungsten; Thermionic Phenomena; Electrical Discharge; Plasma and Oscillations; Structure of Matter; Protein Structures; Properties of Matter; Surface Phenomena; Atmospheric Phenomena; Cloud Nucleation; and, Langmuir, the Man and the Scientist.

AIRBORNE RADAR, by D. J. Povejsil, R. S. Raven and P. Waterman. D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J., 1961. 823 pages, $17.50.

This volume, designed to provide an understanding of basic radar technology and its relation to overall weapons system design, emphasizes the basic principles and systems analysis techniques, and how mathematical models may be developed to solve radar design problems.

Content of the book is based on contributions by leaders in radar engineering and contains some 470 illustrations, graphs and charts.

D. J. Povejsil is Director, New Products Services, formerly Manager, Weapons Systems Engineering, Air Arm Division, Westinghouse Electric Corporation. R. S. Raven is Advisory Engineer, Weapons Systems Engineering, Air Arm Division, Westinghouse Electric Corporation. P. Waterman is Head, Naval Research Laboratories, Radar Division, Washington, D. C.

TRANSMISSION OF INFORMATION, a Statistical Theory of Communications, by Robert M. Fano. John Wiley & Sons, Inc., 440 Park Ave. South, N.Y.C. 16, N.Y., 1961. 389 pages, $7.50.

Foundations and major results of information theory are presented here. Content of the book has evolved from a graduate course taught by the author over the past ten years and includes some previously unpublished research.

Coding theory is provided that emphasizes those formulations and mathematical techniques that have proved to be of greatest engineering significance.

The author presupposes a mathematical background that includes the foundations of probability theory and of Fourier analysis.

Robert M. Fano is Professor of Electrical Communications in the Electrical Engineering Department, Massachusetts Institute of Technology.

ELECTRONIC EQUIPMENT RELIABILITY, by G. W. A. Dummer and N. Griffin. John Wiley & Sons, Inc., 440 Fourth Ave., N.Y.C. 16, N.Y., 1961. 274 pages, $7.50.

The book considers the many aspects of the subject of reliability and presents a summary of present knowledge in order to assist designers and users in obtaining maximum reliability in their equipment.

Mr. Dummer is Head of Components Research, Development and Testing of the Royal Radar Establishment, Ministry of Aviation, England. Mr. Griffin is with the Royal Radar Establishment.

MOTION PICTURE PRODUCTION FOR INDUSTRY, by Jay E. Gordon. The Macmillan Co., 60 Fifth Ave., N.Y.C. 11, N.Y., 1961. 352 pages. $8.00 .

The author has provided a guide to the successful operation of a film department and offers specific suggestions for coping with the large and small problems encountered.

Helpful chapters detail film coding, editing, direction, camera-work and acting for the documentary film. A 20-page glossary of film terms is included.

The late Jay Gordon was Supervisor of Motion Pictures and Audio-Visual Aids for North American Aviation, Incorporated, Autonetics Division. He had served as president of the Industrial Film Producers Association.

A HISTORY OF THE U. S. SIGNAL CORPS, by the Editors of the Army Times. G. P. Putnam's Sons, 200 Madison Ave., N.Y.C. 16, N.Y., 1961. 192 pages, $5.95.

Text, illustrations and photographs review military communications over the past 100 years—from Major Albert Myer's efforts to organize the Signal Corps through the activities of the present organization and its utilization of electronic development.

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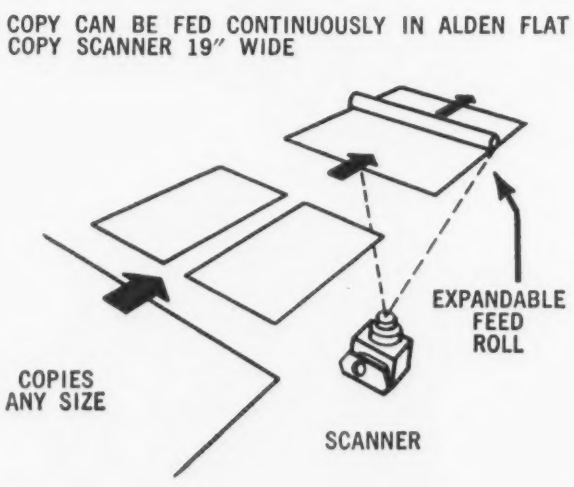

handled — but the most practical speed for the load can be chosen from standard Alden equipment to get the *highest utilization* of the communication link or channel selected. Alden equipment is not fixed at high or low speed. Through the use of modern tape equipment the ability to store at one speed and transmit at another gives *complete flexibility* to any systems layout — insuring highest utilization.

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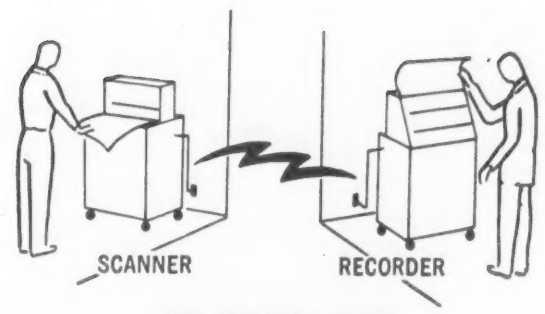

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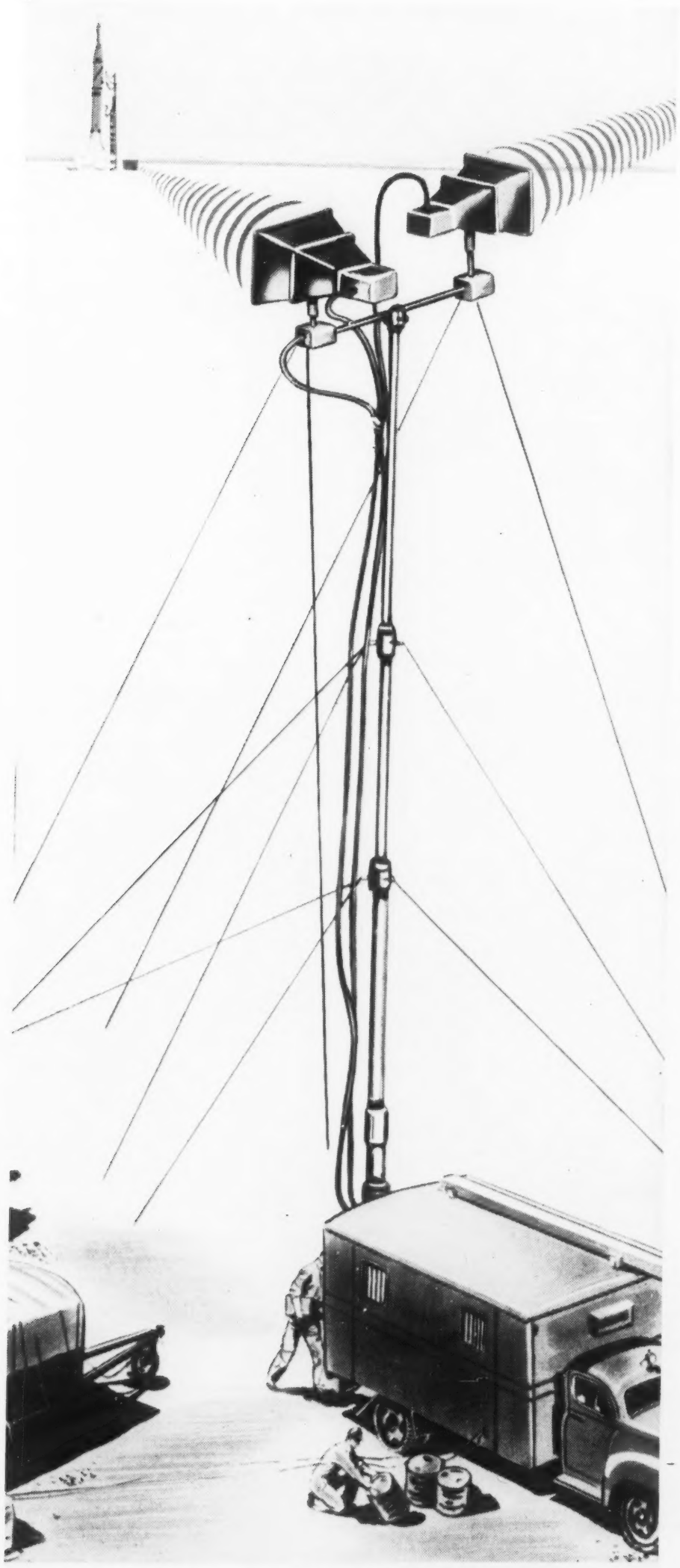

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